

annual report of the

1959 - 60

**indian
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Annual Report
of the
Indian Council of Agricultural Research
for
1959-60



INDIAN COUNCIL OF AGRICULTURAL RESEARCH
NEW DELHI

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Introduction

THIS is the 30th Annual Report of the Indian Council of Agricultural Research giving in brief a survey of the activities of the Council towards development of agriculture in the country during 1959-60.

Among the official changes during the year, the most important has been the appointment of Shri J. S. Patel as Agricultural Commissioner to the Government of India vice Shri B. N. Uppal. Shri M. S. Pawar took over as Deputy Agricultural Commissioner on reversion of Shri M. U. S. Jung to the Uttar Pradesh Government. Another important feature, in the official changes was the redesignation of the Statistical Wing as 'Institute of Agricultural Research Statistics.'

During the year, continuance of 93 current research schemes at a cost of Rs. 13.53 lakhs was sanctioned and 89 new schemes with an allotment of funds to the tune of Rs. 9.83 lakhs were sanctioned.

Forty-eight meetings of various bodies were held during the year.

AGRICULTURAL RESEARCH

Rice. The highlight of the agricultural research during 1959-60 has been the work towards evolution of better varieties of cereals, pulses, fruits and vegetables. Far reaching work was done towards evolution of 455 improved varieties of rice suitable for plains and low level of fertilisation and their release to a number of seed multiplication and distribution centres in various States. Research work on breeding rice in special conditions like flood and deep water, drought, salinity and hilly conditions has yielded quite encouraging results. Work on flood-resistant rice is going on in Andhra Pradesh, Madras, Uttar Pradesh, Assam and Kerala. The best results coming from Andhra Pradesh show that variety 1311 was found to withstand for more than two months submergence under five feet water. It gave a higher yield too. It recorded 2,208 lb. per acre when the average yield in the neighbouring areas was only 500-800 lb. per acre. Another variety known as variety 1315 also has been found equally suitable for flood conditions.

Work on salt resistance is in progress in West Bengal, Madras and Andhra Pradesh. C. 72 and C. 87 have been found to be much superior to the local varieties in Andhra Pradesh. West Bengal has also reported a few promising soil resistant strains.

Work on research in diseases of rice continued in Kashmir, Maharashtra, Madras and Andhra Pradesh with good results.

Wheat. Research work to evolve varieties resistant to rusts and other diseases of wheat was conducted in Bombay, Rajasthan, Punjab, Bihar, Uttar Pradesh, West Bengal, Andhra Pradesh, Himachal Pradesh and Delhi. Seventy-four

trials were laid out in eleven States. It was observed that N.P. 823 and N.P. 824 were promising in Andhra Pradesh, Mysore, Bihar and Uttar Pradesh, N.P. 824 in parts of Maharashtra, Delhi and Rajasthan, N.P. 825 in Delhi and some parts of Rajasthan and N.P. 830 in Punjab. In hilly tracts, recently bred wheats N.P. 828 and N.P. 829 rendered an excellent account of themselves by out-yielding the Ridley variety. A new discoccum wheat possessing combined resistance to black and brown rusts and suitable for wheat growing tracts of Peninsular India has been evolved. Research on inter-specific and inter-generic hybridization of Indian wheat was also conducted at Poona.

Maize. Under the co-ordinated maize breeding scheme efforts to evolve hybrid maize suitable to different agro-ecological regions of the country, continued. In 1959 *kharif*, 5,292 inbred lines (some bred in India and some introduced from abroad) and 3,083 varieties and varietal crosses were grown. Twenty-seven co-operative yield trials were conducted.

Forage and fodder investigations were in progress in West Bengal, Bihar, Bombay, Madras, Madhya Pradesh and Mysore and some good work towards investigation of short season and more nutritive fodder was done during the year under report.

Agronomy. Green manuring investigations continued in Andhra Pradesh, Bihar, Bombay, Mysore and Uttar Pradesh to find out promising green manuring plants and to study their effects on the yield of major staple crops. Hubam clover and *Vicia* sp. were found promising with late paddy at Kanpur. Inter-cropping with suitable types of green manure plants was found to be a profitable practice in many places.

Quite far reaching work was done towards investigations of methods of control of weed and protection of crops from the damage done by the termites. Effective weedicide formulations and techniques were devised for controlling weeds like *kans*, nutgrass, *doob*, oxalis and *piazi* which are dangerous for crop.

Fertilizer trials and agronomic experiments were organized. A total number of 7,230 trials were conducted in various States. Under the Fertilizer demonstration scheme nearly 110,000 demonstrations were laid out in various parts of the country during the year.

Tuber Crops. Under the *ad hoc* schemes on development of tuber crops some remarkable work was done. As a result of tests V_2 , V_8 , B219, B_{12} and V_6 varieties of sweet potatoes were found very promising for Madras State. L.12, L.32, F.A. 17 Red, Poona 3, Delhi 6 and American 7 were found promising and are being recommended for cultivation in Madras.

Vegetables and Fruits. Vegetables form an essential part of the Indian diet. The population being mostly vegetarian, the present production is not very satisfactory. Under co-ordinated scheme in operation in Madras, Andhra Pradesh, Punjab, West Bengal, Madhya Pradesh, Bombay and Uttar Pradesh concerted efforts are being made to improve the quality and step up the production of the vegetables in India. As a result of the efforts at various centres under the scheme, improved strains of commercially grown vegetables like *bhindi*, brinjal, tomato, cabbage, cauliflower, beans, gourds, leafy vegetables etc. are now available for distribution. Madras has reported four tomato selections with a yield of 18,317

to 24,154 lb. per acre. In brinjals also S.M.-6 has given a yield of 11,826 lb. per acre which shows an increase of 32.4 per cent. In West Bengal, the problem of maintaining stock seeds of caged plants of cabbage and cauliflower has been solved by employment of bumble bees as pollinators. Research on onions too made some advance.

Banana is one of the important and most cherished fruits. Research on this fruit is being carried out at Aduthurai, Poona and Chinsurah under the Co-ordinated Banana Research Scheme. At Aduthurai, fundamental aspects of the fruit are being studied; hybridization work is in progress and hybrid progenies are under study. At the Poona Station, investigations are under way to study the varietal, cultural, agronomical, ripening, packing and transportation aspects of the fruit. Experiments on diseases of citrus are being successfully carried out at three centres in Mysore State, Bombay State and Delhi. Work on rootstock trials, description of varieties and control of fruit pests made some headway during the year. Research on agronomic and entomological aspects of mango, guava, *ber*, papaya, date-palm, pineapple, cashew, sapota etc. continued at their centres established throughout India.

The co-ordinated scheme to study the role of growth regulating substances in horticulture also made some headway in the Punjab and Andhra Pradesh.

All India fruit shows were held to publicise the improved strains.

Agricultural Implements. Under the scheme for production, demonstration, trial and popularisation of improved agricultural implements, 116 improved agricultural implements were supplied to various States for test and report, so that manufacturing of the same may be arranged in the country.

Six Australian scythes were procured and put to test at the Agricultural Engineering Division, I.A.R.I. Thirty sets of Australian scythes which have proved far superior to the local one, are being secured and will be distributed to the States for trial.

The survey of indigenous agricultural implements was completed. The All India report of the survey is in the process of printing.

Research on coconut, arecanut, oilseeds, cotton, tobacco, jute and lac continued under Commodity Committees. The schemes in operation for development and research on these commodities showed progress, in general.

Pirrcom. Under Pirrcom six new centres were started during 1959-60 with the object of organising agricultural research on a cross-commodity basis and to deal with the agricultural problems on a regional basis.

Botanical studies were conducted in jowar and *bajra* at Delhi, Sirsa, Ajmer, Gwalior, Mohol and Bellary.

Botanical and agronomical studies, rotation, inter-cultural and weed control investigations were undertaken on groundnut and castor at Hyderabad and on *toria* and *taramira* at Patiala.

Studies on cotton and its diseases were taken up at Sirsa and Coimbatore.

Animal Husbandry. In the animal husbandry schemes, cattle breeding occupied a prominent place. Various schemes for selective breeding and grading up of the cattle are in operation all over the country and trials are being made to improve the breed of cattle through scientific breeding to improve the milking capacity of the cows and wool quality in the sheep. A number of trials were made

in the centres located in Orissa, Bihar, West Bengal and Madras. Work on the scheme in Hissar started with the object of finding out whether by careful breeding and selection, the two important characters in Haryana cattle namely milk yield and draftability can be suitably combined to evolve a dual-purpose-type animal, made some headway. Experiments and trials are going on. The Central Artificial Insemination Station, Bangalore despatched to various centres 56,980 cc. of Jersey semen, 37,395 cc. of Sindhi semen, 4,758 cc. of Tharparkar semen and 61,979 cc. of Murrah semen. The scheme for finding out ways and means of spreading calving season in buffaloes throughout the year for ensuring even supply of milk, started at Izatnagar during 1958, made some headway in collecting the required data.

Under the scheme for sterilization of scrub cows, some experiments with intrauterine injection of hard paraffin were conducted. Stainless steel tension clips were introduced in the cervix of six cows which are now under observation. A suitable design of an instrument for electro-cauterisation of cervix was developed and some private firms have been contacted to manufacture it.

Animal Diseases. A number of schemes for investigation and control of diseases of cattle, buffaloes, sheep, goats, pigs, and poultry, like mastitis, brucellosis, contagious pleuropneumonia, humpsore, etc. continued to function in almost all the States and the I.V.R.I., Izatnagar. The scheme for improvement of various rinderpest vaccines continued at I.V.R.I. It is now possible to take up production of lapinised-avianised virus on large scale for use in the fields.

Dairying. The scheme for development of standardisation of methods for detecting adulteration and determining major constituents of milk was started at Hoshiarpur (Punjab) in 1958. Further work on determination of interfacial tension of milk and on freezing point of milk was done during the year. A survey was conducted in Bombay for studying the bacteriological quality of the milk under another scheme. Nearly 3,000 samples were studied during the year. Similar surveys were conducted at Allahabad and Delhi. Detergent properties and bactericidal efficiency of various cleaning mixtures were tested. Three types of cleaning mixtures have been evolved to clean milk utensils for increasing keeping quality of milk in transportation to far-off places.

Hides and Skins. A scheme for finding out a suitable method for manufacture of chrome retan leather had been in operation till February, 1959. A technique has now been worked out to manufacture retan leather from inferior cow hide. The retan process imparts fullness and better feel to the leather, absorbs more fatliquor and gives a suitable embossing. The scheme for manufacturing leather boards from tannery waste materials has made remarkable progress and processes have now been worked out to prepare satisfactory boards from the tannery waste.

Agricultural Statistics. The Statistical Wing which has now been redesignated as Institute of Agricultural Research Statistics continued its advisory work on statistical aspects of the designs and lay-out of agricultural and animal husbandry experiments and interpretation of their results. A large number of enquiries received from the United Nations Organization, various departments of Central and State Governments, the Commodity Committees and other Institutes were attended to.

Nine types of complex factorial experiments on manurial, cultural, rotational and irrigational problems are being conducted at 30 centres. Over 8,000 simple fertilizer trials were conducted in the States of Andhra Pradesh, Assam, Bihar, Delhi, Himachal Pradesh, Kerala, Madras, Mysore, Orissa, Rajasthan, Punjab, Uttar Pradesh and West Bengal. Under the fertilizer demonstration trials scheme started in 1954 in collaboration with Technical Co-operation Mission of the U.S.A., data of 2,000 demonstrations conducted in *kharif* and 1,000 demonstrations conducted in *rabi*, 1958 were analysed. A survey of fertilizer practices is being conducted in various areas of the country. Pilot sample surveys to study cultivation practices of fruits are in progress. The training courses organised by the Statistical Wing were conducted as in previous years.

Agricultural Education. Various steps have been taken by the I.C.A.R. to promote agricultural education in the country. For the first time in the country it has been decided to establish an Agricultural University, more or less on the lines of Land Grant Universities of the United States of America.

Post-graduate courses were started at the Agricultural College, Coimbatore and the Veterinary Colleges, Mathura and Madras in 1958, at Agricultural College Ludhiana, in 1959 and similar courses are likely to be started at Patna and Bombay from July, 1960.

Refresher courses were held in plant breeding, agricultural engineering and soil science for the benefit of teachers in agricultural colleges.

Two seminars on teaching methods of agricultural education were held at Bombay.

Publicity. The publication programme was greatly expanded during the year under report. Two more journals, i.e., Indian Journal of Agricultural Education and Indian Potato Journal were started during this year. Besides, the journals and magazines, normally printed, four monographs, five books on different subjects and 17 bulletins and pamphlets were issued during the year.

CHAPTER I

Administration

THIS is the 30th Annual Report of the Indian Council of Agricultural Research presenting a general review of the activities of the Council during the year 1959-60.

Official Changes. During the period under report Dr. B. N. Uppal relinquished charge of the post of Agricultural Commissioner with the Government of India and Dr. J. S. Patel, permanent Director of Agriculture, Bihar and until recently, Agricultural Adviser in the Ministry of Community Development and Co-operation, was appointed Agricultural Commissioner with the Government of India. Shri M. U. S. Jung, Deputy Agricultural Commissioner reverted to the Government of Uttar Pradesh and was succeeded by Shri M. S. Pawar, an officer of the Government of Andhra Pradesh.

Shri Prem Nath, formerly an Editor in the Indian Council of Agricultural Research, was appointed as the Chief Editor and Production Specialist in Publication Wing of the Council.

The Statistical Wing of the Council was re-designated as the "Institute of Agricultural Research Statistics".

Allotment of Funds. During the year under review, the Indian Council of Agricultural Research sanctioned the continuance of 93 current research schemes at a cost of Rs. 13.53 lakhs (Appendix 1). It also sanctioned 89 new research schemes in Agriculture, Animal Husbandry Statistics etc., with an allotment of funds to the extent of Rs. 9.83 lakhs (Appendix 2). Seventy one schemes terminated during the year (Appendix 3).

Finance and Accounts. The following were the receipts from (i) the Cess levied under the A. P. Cess Act, 1940, (ii) the grants received from the Government of India and (iii) grants from other sources.

i. Receipts from the Cess—Rs. 49,46,604

ii. Grants from the Government of India

	Rs.
1. Setting up of an Agriculture Education Stall in the pavilion of the Council in the World Agricultural Fair	14,000
2. Rinder-pest eradication—preparation of propaganda material	25,000
3. Weed control	2,700
4. Production of agricultural instructional films	2,00,000
5. Scheme for ascertaining the cost of milk production	1,47,400

6.	Manurial and agronomic trials	..	..	..	..	54,000
7.	Co-ordinated cattle sterility	..	..	..	..	12,352
8.	Wheat rust control scheme	..	..	..	..	6,208
9.	Establishment of research-cum-testing centre for bullock driven agricultural implements	..	..	..	..	27,100
10.	Pilot investigation for collection of statistical data on yield and extent of cashewnut cultivation and the practices adopted in its cultivation	..	..	..	..	17,100
11.	Pilot investigation for collection of statistical data on yield and extent of cardamom cultivation and the practices adopted in its cultivation	..	..	..	..	7,000
12.	Study of milk yield, breeds and management practices of Bovine	..	..	..	..	85,000
13.	Scheme for research and development of pepper and cashewnut etc.	..	..	..	..	55,000
14.	Pilot survey for study of cultivation practices of pepper and their influence on yield	..	..	..	..	8,000
15.	Study of feeding and rearing practices of sheep and yield of wool in Joria region of Bombay	..	..	..	..	75,000
16.	Pilot scheme for study of poultry practices and production	..	..	..	..	33,375

iii. Grants from other sources

<i>S. No.</i>	<i>Name of the organization</i>	<i>Purpose</i>	<i>Amount</i>
1.	Indian Central Tobacco Committee, Madras.	Reconciliation of differences in the tobacco area figures reported by the Central Excise staff and State revenue staff.	Rs. 2,720
2.	Indian Central Oilseeds Committee, Hyderabad.	Sale arrangements of monographs issued by Commodity Committees.	„ 2,000
3.	Indian Central Tobacco Committee, Madras.	-do-	„ 2,000
4.	Indian Lac Cess Committee, Ranchi.	-do-	„ 2,000
5.	Indian Central Coconut Committee, Ernakulam.	-do-	„ 2,000
6.	Indian Central Oilseeds Committee, Hyderabad.	Project for intensification of regional research on cotton, oilseeds and millets.	„ 3,09,700
7.	Indian Central Cotton Committee, Bombay.	-do-	„ 93,548

Meetings. Forty-eight meetings of the various bodies of the Indian Council of Agricultural Research were held during the year (Appendix 4).

Lists of members of the Indian Council of Agricultural Research Society, Governing Body, Standing Finance Committee and Advisory Board are appended (Appendices 5 to 8).

CHAPTER II

Agricultural Research

CEREAL CROPS AND MILLETS

Rice. Research on rice is being carried on in India for nearly last 50 years. As a result of the research during this period, 455 improved varieties have been released quite a number of which figure prominently in the various seed multiplication and distribution schemes of the States. Above mentioned varieties are suitable for plains, for a low level of fertilization and for normal situations. Rice breeding in special conditions like flood and deep water, drought, salinity, hilly conditions and resistance to blast and borer, has been going on for the last few years and these have started yielding results. At the last Advisory Board Meeting it was pointed out that the *indica-japonica* hybridization project gave very valuable results in Andhra Pradesh. Fresh results from this centre confirming the above reports point out that yields of the order of about 50 per cent in excess of the old improved varieties have been obtained. Similar results have also been received from Maharashtra and Orissa.

Flood Resistant Rice. Work on flood resistance is going on in Andhra Pradesh, Madras, Uttar Pradesh, Assam and Kerala. The best results have come from Pulla station in West Godavari District of Andhra Pradesh. Here, under exacting flood conditions, variety 1311 was found to withstand submergence under five feet water for more than two months. When harvested it recorded 2,208 lb. per acre while the neighbouring ryots got only about 500-800 lb. per acre. Another variety 1315 has been found suitable for conditions of submergence below five feet. The third variety Burma Akkulu is suitable for conditions of intermittent flooding.

Salt Resistant Rice. Work on breeding salt resistant rice is in progress in West Bengal, Madras and Andhra Pradesh. Masulipatam station of Krishna District in Andhra Pradesh has confirmed that C. 72 and C. 87 are significantly superior to the local varieties and SR. 263 of Orissa. The yield of new strains is significantly higher, their straw is stiff and they are less susceptible to borer attack. West Bengal has also reported a few promising salt resistant strains.

Drought Resistance. The work under drought resistance in Madras and Kerala has so far not given any definite results and the schemes are being continued.

Blast Disease. Work on breeding against blast is in progress in Kashmir, Bombay, Madras and Andhra Pradesh. Strain 6522 has been found resistant to blast in both the States of Madras and Andhra Pradesh and strains 6538 in Madras and 6517 in Andhra Pradesh have also exhibited good amount of resistance.

The scheme for the botanical survey and collection of breeding material from Jeypore tract of Orissa State has successfully concluded, 1,930 collections having been made during the course of the survey of which 1,766 belong to the cultivated types and 164 to wild types. The collection includes glutinous and semi-glutinous types, scented varieties, varieties having long sterile glumes, double grain and clustered types. One of the noteworthy features is that the grains measuring over 12 mm. in length which hitherto had come only from the material obtained from outside India are now available from the Jeypore collection. This valuable collection is being carefully stored for use in future rice breeding projects.

Lodging disease. Studies on the lodging of rice conducted by the Central Rice Research Institute at Cuttack brought to light the points that (i) ridged plots gave significantly better yield than unridged plots and (ii) pruning of leaves, delayed lodging by 15 days, but had a highly deleterious effect on yield.

The project co-ordinator for the rice stem-borer schemes in West Bengal, Madras and Andhra Pradesh has gone through the data submitted for proposals for extending this project. Folidol and Endrin were found to give effective control when the sprayings were synchronized with brood emergence. Removal of egg masses showed that while the infestation was kept down a little there was no appreciable increase in the yield. Trap-crop-nursery was found of limited use in controlling the borer attack. Regulating dates of sowing avoided borer trouble to a fair extent. The dates of sowing and transplanting naturally are different for different seasons and States.

Wheat. Research work on wheat was conducted in Bombay, Rajasthan, Punjab, Bihar, Uttar Pradesh, West Bengal, Madhya Pradesh, Andhra Pradesh, Himachal Pradesh and Delhi with an aim to evolving varieties resistant to the three rusts and other diseases, being at the same time agronomically superior.

Seventy-four trials with N.P. wheats the 800-series were laid out in 11 States. The data show that N.P. 823 and N.P. 824 have done well in Andhra Pradesh, Mysore, Bihar and Uttar Pradesh, N.P. 824 in parts of Bombay, Delhi and Rajasthan and N.P. 825 in Delhi and parts of Rajasthan. N.P. 830 holds a high promise for Punjab. N.P. 827 and 828 were found to be highly susceptible to *Alternaria* in Bihar. For the hilly tracts, N.P. 770, N.P. 809 and Ridley confirm the superiority of earlier years. The recently bred wheats N.P. 828 and N.P. 829 have rendered an excellent account of themselves by out-yielding even Ridley. A new discoccum wheat, possessing combined resistance to both black and brown rusts and suitable for wheat growing tracts of Peninsular India, has been evolved. In Bombay, it was noted that a new virulent strain of race 42-B of black rust infected Gaza and its progenies. Care has been taken to utilize this new virulent strain for tests in the glass house only.

Besides breeding work, research on inter-specific and inter-generic hybridization of Indian wheats was conducted at Poona. Studies on rust resistance were pursued at a number of stations.

Barley. At the Indian Agricultural Research Institute, New Delhi a number of varieties of barley were tested for their reaction to black and yellow rusts at the seedling stage. None of the varieties, however, were found to be resistant.

At the Wellington centre in the Madras State a new barley strain which possessed agronomic superiority and was resistant to yellow rust and to loose and covered smuts gave 84 per cent more yield than the local variety.

Pulses. During the year under review, schemes aimed at improving the pulse crops were in operation in the States of Bombay, Andhra Pradesh, West Bengal and Madhya Pradesh. The Madhya Pradesh scheme brought to light the fact that the selection from the local material was ineffective as the genetic base was very narrow. The scheme was, therefore, extended conditionally that material from other States and, if necessary, from other countries be imported for trials.

Bombay. The scheme in Bombay gave some useful results. In *kharif mung*, hybridization was done with a view to combine bold seed size, erect habit, top bearing and earliness. When the hybrids were tested for the first time for their yield, it was found that seven of them out-yielded the parent by a margin of 20-50 per cent. Four strains of *kharif urid* were reported to be superior to local varieties. Work in *rabi urid* crop showed that the N.P. strains were too early for Bombay conditions, but five selections from the local material out-yielded the control by 33-46 per cent. Similarly four *rabi moth* strains were found to be significantly superior to the local. In gram, nine Niphad strains recorded a superiority of 25-34 per cent. A number of Pakistan varieties of gram were found to be very late in maturity and poor in yield.

Andhra Pradesh. The scheme in Andhra Pradesh is a new one and is being operated at the three Regional Stations of Kadiri, Zam and Samalkota. The last station falls in the Godavari delta where pulse crops such as *mung* and *urid* are sown soon after the harvest of the main paddy crop. At the other two centres, the crops are raised in the *kharif* season with the onset of monsoon. In all, six crops, viz., *arhar*, *kulthi*, *mung*, *urid*, cowpea and gram are being handled.

Bengal. The work in Bengal showed that *arhar* and *aus* paddy can be successfully grown as a mixed crop. Improved strains of lentil yielding 20-40 per cent more than the local have been isolated and one of them has recorded a protein content of 30 per cent. Gram No. 75 is reported to have given consistently high yield in Berhampur. Another selection, S-4 has recorded a protein content of 19 per cent.

Co-ordinated Maize Breeding Scheme. The Co-ordinated Maize Breeding Scheme the objective of which is to evolve hybrid maize suitable to different agro-ecological regions of the country entered the third year. One of the important features of the scheme is the testing of germ-plasm collected from all over the world. In the 1959 *kharif*, 5,292 inbred-lines, some developed in India and some introduced from abroad and 3,083 varieties and varietal crosses were grown in addition to the 27 co-operative yield trials.

In general, at Srinagar, the South-American and the most southern U.S. varieties and varietal crosses showed a lack of adaptation. At Hyderabad, a number of corn belt and other U.S. lines appeared to be well adopted. Here again, some of the lines proved suitable for *kharif* only and others for *rabi*. The desirability therefore, of setting up a separate breeding programme for *kharif* and *rabi* seasons is being explored.

U.S. Hybrids. Twelve U.S. hybrids were found to be consistently superior in yield at two or more locations. Out of these twelve, eleven belong to the southern region of the U.S. While these hybrids are performing very well, difficulty

is experienced in propagating successfully inbred-lines involved in making the parental single crosses.

Double Cross Trials. A study of several double cross yield trials shows that few of the hybrids are significantly superior to the local cheek. Emphasis, therefore, is being placed on line evaluation and double cross prediction tests as prerequisite for determining as to which lines in combination should go into experimental double cross hybrids. Lines other than those of exceptional performance result in unsatisfactory hybrids, and, therefore, random combinations of inbred-lines are being avoided.

Pests and Diseases. Among the pests, the borer *Chilo zonellus* is found to be most destructive. Efforts to select inbreds or varieties which can be considered completely tolerant to borers have so far been unsuccessful. Therefore, it is proposed to make a wider collection and screen it with the help of a maize entomologist.

Bacterial rot, leaf blight, downy mildew and rust are the important diseases. The first three are widespread while rust is severe in the Himalayan area and South India. Besides these, there are a couple of diseases that have so far remained unidentified. Studies show the possibility of getting lines resistant to bacterial rot and helminthosporium.

ENTOMOLOGY AND ANIMAL PESTS OF CROPS

Fundamental work on the physiological relationship between insect pests and their host plants continued to engage the attention of workers at the Delhi University. The relative nutritional value of various parts of the cotton plant for *Oxycaenus hyalinipennis* was determined. Cotton seed, along with water, satisfied all the nutritional needs of the insects, while the leaf, the green boll and other succulent parts of the plant failed to support the growth or fecundity of the insect. On the basis of these observations, it appeared possible to establish some correlation between the relative preferences of the insect for various parts of the plant, their nutritional value and the insect's ability to utilise the available nutrients.

Identification of Insect Schemes. At the Agricultural Research Institute, Coimbatore and Bapatla, schemes for identification and naming their insect collections continued to operate. The discovery by the Coimbatore workers of the occurrence of the eelworm (*Heterodera marioni* Cornu) as a pest on the recently introduced Oysternut plant (*Telfaria pedata* H) is a new record in India.

Termites as Crop Pests. Research on termites as crop pests was actively pursued at the Indian Agricultural Research Institute, Delhi and the Institute of Agriculture, Anand. One of the effective methods for the protection of sugarcane setts from termite injury was found to be dusting 2.5 per cent Dieldrin at a rate of 25 lb. per acre. The effectiveness of the application of five per cent D.D.T. in kerosene in December to mango tree stems for keeping them free of termites was confirmed. The method now offers a promising line of attack on this troublesome widespread pest of the mango all over the country.

Animal and Bird Pests. A practical approach to scare off the bird pests of grain crops by reproducing their distress calls continued to engage attention in Poona. The use of an automatic sound producer proved to be satisfactory in dealing with the harmful migratory birds.

Field Rats. Field rats as pests of crops have been almost an insolvable problem. A notable advance in the year was the production, through a three-year study undertaken at the Delhi University, of an effective bait consisting of zinc phosphide and wheat flour and a little sugar mixed in the proportion of 1:12, which gave a kill of 75 to 90 per cent under field conditions.

Toxicology and Toxicity Hazards of Modern Synthetic Pesticides. The rapidly increasing types of insecticides and their wide use has created the problem of toxicity. The Agricultural Research Institutes at Delhi and Coimbatore continued to investigate on the hazards involved in using these substances. In the trials at Delhi, insecticidal residues in various degrees were found to persist in field crops of *bhindi*, cabbage, maize and tomato even up to a fortnight after their application. The measures to ensure safety from the harvest time residues still remain to be investigated.

AGRONOMY

The main agronomical investigations fall broadly into three branches, namely (i) studies on fodder and forage crops, (ii) green manuring investigations and (iii) research on weeds and their control.

Fodder and Forage. Fodder and forage investigations were in progress in Andhra Pradesh (Rajindranagar), West Bengal (Haringhatta), Bihar (Dumaron), Bombay (Poona), Madras (Coimbatore), Madhya Pradesh (Seoni), Mysore (Dharwar, Kudige and Mandya) and at the I.C.R.I. The main objectives of these studies were (a) production of suitable short-season fodder crops for catch cropping in between the staple *rabi* and *kharif* crops, (b) formulation of suitable grass legume mixtures with a view to get high tonnage of nutritious forage and (c) evolution of improved varieties of annual and perennial grass-legume fodder crops for growing under different conditions and raising the more promising among them under optimal farming conditions. In these, the rotational studies (at Haringhatta and Mandya) indicated that, apart from leguminous fodder species, short-duration pulse crops like black gram, green gram, cowpea and soyabean could advantageously be adopted as catch crops between the main staple crops for fodder purposes. Similarly, in the cultivation of fodder types, grass legume mixture (viz. teosnite-black gram or *guar* or cowpea and *Phalaris minor*-peas or vetches at Dumaron and *Sorghum dolichos* at Coimbatore) could be advantageously adopted for greater production of nutritious forage.

Improved types of annual (*Melilotus*, *Medicago*, *Trifolium*, *Cenchrus*, *Brachiaria*) and perennial grass and legumes (*Calapagonium*, *Centrosema pennisatum*, etc.) with high tonnage of production and also suiting to various environmental conditions like water-logged areas (*Brachiaria mutica*, etc.) and pasture lands (*Indigofera endeiaphylla*, *Centrosema pubescens*, etc.) were also evolved at various stations. Improved techniques like optimum seed rates, manuring and cutting were also evolved at Mandya, Dumaron, Coimbatore and elsewhere. For example, combination of five tons of FYM with A/S at 30 lb. N per acre was the best for grasses like *Cinchrus glaucus* at Coimbatore. Application of 40 and 80 lb. of P_2O_5 per acre increased the yield of leguminous fodder like berseem by 26 and 63 per cent

respectively at Dumaron. The dosage of 30 N and 40 P increased the yields of guinea and rhode grasses by 35 and 16 per cent respectively at Mandya.

Green Manuring. Green manuring investigations were in progress in Andhra (Rajindranagar), Bihar (Sabour), Bombay (Poona), Mysore (Mandya) and Uttar Pradesh (Kanpur). The main items of the investigations included the study of promising green manuring plants, and their influence on the yield of major staple crops and also the evolution of suitable types of plants and technique to fit in the existing cropping practices in mixtures or crop sequences. In the study of green manuring crops in rotation, hubam clover and *Vicia* sp. (Chatri Matri) were the most promising with late paddy at Kanpur. Inter-cropping with suitable types of green manure plants (viz. six rows of jowar inter-spaced with one row of *san* at Rajindranagar, cowpea, black or green gram with cotton at Poona and *Aeschemomone americana* with maize at Sabour) was found to be a profitable practice in many places. The practice of green manuring with suitable types of plants stepped up substantially (about 50 per cent) yields of rice and wheat at Sabour, while at Rajindranagar, it increased maize yields by two to three times. These findings are being confirmed.

Weeds and Their Control. Co-ordinated weed control investigations were in progress in Andhra Pradesh (Lam), Assam (Jorhat), Bombay (Nagpur), Himachal Pradesh (Solan), Madhya Pradesh (Gwalior and Sehore), Punjab (Ludhiana), Rajasthan (Ajmer) and Uttar Pradesh (Agra). Some of the main lines of investigations included formulation of weedicidal technique for the control of the common crop weed *in situ*, and also such measures for the pernicious waste-land weeds like *kans* and nut-grass.

Application of different doses and formulations of weedicides like 2, 4-D controlled rice, wheat, maize, jowar, and potato weeds in various stations. The timing and schedule of weedicidal operations were also formulated to effect maximum damage to weed with minimum injury to crop yields. The broad indications were that, cultural methods combined with weedicidal applications were the best practice. For example, the application of 24 oz. of 2, 4-D in 60 gallons of water per acre before and after the emergence of weeds followed by cultural methods controlled weeds of fields of broadcast and transplanted paddy, maize and potato crops at Jorhat. Effective weedicidal formulations and technique were formulated for controlling weeds like *kans*, nut-grass, dub, oxalis, *piasi* at Bhilsa, Nagpur, Gwalior, Solan and Ludhiana. About 87 per cent of *kans* was killed by nine per cent sodium salt T.C.A. and 90 per cent of dub, with six per cent while the application of 2 lb. acid equivalent of Ethylester of 2, 4-D (Dicotex) per acre applied in four weeks intervals controlled nut-grass at Nagpur. Spraying oxalis when in flower with ester of 2, 4-D at half a gallon per acre reduced the bulb formation by about a third at a cost of Rs. 17/- per acre at Solan. *Piasi* was similarly controlled by Fernoxone spray (10-20 oz. per acre) at Ludhiana.

FERTILIZER TRIALS AND MODEL AGRONOMIC EXPERIMENTS

The main objective of the scheme is to estimate the average response to doses of nitrogen, phosphate, potash for important field crops and to study the variation in different agro-climatic regions of the country.

Co-ordinated Scheme of Simple Fertilizers Trials. Three types of trials are being conducted in statistically selected villages. The work has been started in 100 districts out of the 200 districts selected for experimentations. Total number of trials conducted was 7,230 against a target of 19,468. The yield data received from different States are being compiled for analysis. Arrangements are being made to extend the work to other districts.

Model Agronomic Experiments Scheme. Under this scheme complex experiments connected with various fertilizers and agronomic practices are being conducted on 15 acre blocks. The blocks are located on cultivators' holdings or seed multiplication farms. Experimental work was in progress at 32 centres out of 34 proposed under this scheme. During *kharif* and *rabi* 1959-60, 100 and 72 trials were conducted respectively. The results of these experiments have been statistically analysed and reports are being prepared for publication.

Fertilizer Demonstration Scheme. The Fertilizer Demonstration Scheme was continued in 1959-60. Four thousand tons of different fertilizers were allocated to the States for free distribution to cultivators to lay out demonstrations. An estimated number of 110,000 demonstrations have been laid during the year.

These demonstrations have paved the way of increasing the consumption of nitrogenous fertilizer by five times and of phosphatic fertilizers by three times over 1954-55. But the consumption rates of N:P, which is 10:1 is not considered satisfactory. The consumption of phosphatic fertilizers has to be stepped up by more intensive demonstrations and publicity in future in order to improve this ratio of N:P.

Fertilizer mixtures of grades 12-6-0 and 12-6-6 were distributed in all the States and of grade 12-6-12 in potash deficient areas for demonstration.

A beginning has been made to demonstrate the fertilizer placement technique on a limited scale.

Agronomical investigation on jowar carried out at Amravati and the study on the potentialities of intensive cultural practices on small holdings at Calcutta provided useful data. The report of the Meteorological Department, Poona gave interesting and useful information on the influence of weather on the phasal progress of crop production and on the parallel incidence of pests and predators. The survey of fertilizers in the districts of West Godavari, Coimbatore, Barabanki, has provided information on distribution of fertilizers amongst different crops, types and quality of fertilizers applied, time and method of application and other related factors. This is being extended to other districts.

SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

Various aspects of soil science and agricultural chemistry, such as land utilization, nitrogen fixation, phosphate utilization, micro-nutrient studies and some fundamental studies and techniques were undertaken at different State Research Stations. The investigation on reclamation of land was in progress in Andhra, Bombay, Punjab (Amritsar and Ludhiana), Madras and Uttar Pradesh (Lucknow University and Shila Dhar Institute). This included survey of saline and alkaline areas, study of their plant population and evolution of effective reclamation technique

through crop rotation and through mechanical and chemical soil ameliorative measures. Crop rotations of dhaincha-green manuring paddy-berseem was the best at Ludhiana, while mechanical measures like trenching combined with flooding successfully reclaimed lands in Madras. Application of fertilizers and soil ameliorants (like gypsum, sulphur, molasses, pressmud and green manure) also successfully reclaimed land particularly in Andhra, Amritsar and Madras. Shila Dhar Institute studies at Bhupal Sagar showed that, application of ten tons of pressmud with 100 lb. of bonemeal was the best for reclaimed land which in turn produced rice successfully.

The soil at Amritsar is highly deteriorated, containing all types of sodium salts, carbonate, bicarbonate, chloride and sulphate. The total soluble salts ranged from 0.1 to 7.6 per cent and pH from 8.8 to 10.5. Lucknow investigations indicated that, plants in the highly saline and alkaline soils often show a high tissue concentration of sodium, molybdenum and boron and generally low values of potassium, phosphorus, calcium, manganese and sometimes also copper. Marked response to N, P and K was obtained. Application of N and K gave negative response to calcium, magnesium, phosphorus and manganese while application of phosphate brought about a similar negative response on the molybdenum content of barley plants.

Nitrogen Fixation. Studies on various aspects of nitrogen fixation i.e., (a) nitrogen fixation power of legumes (Andhra and Bombay), (b) effect of legume seed inoculation in Bengal and (c) photo-chemical fixation of nitrogen at Shila Dhar Institute were in progress during the year. The work at Bapatla showed that, inoculation in addition to phosphate (15, 30 and 45 lb. P_2O_5 per acre), application increased both the percentages of nitrogen and total protein in the sunnhemp variety BAS-201, which was found to be the most outstanding for the purpose.

Poona studies showed that, there was little change in soil nitrogen when the plants (black and green gram at Sheori) including roots were harvested. Application of phosphate (110 lb. P_2O_5 per acre) did not show any change in the nitrogen content of the different soils (i.e., deep black, laterite and Goradu). Nonetheless phosphate application increased the concentration of nitrogen and dry matter in plants. Also, it caused more and heavier nodules, which were particularly marked in Sheori. But, at the same time, the nitrogen content in the nodules did not show a corresponding increase with their number.

The work at the Presidency College showed that inspite of the favourable pH of the paddy soils of Bengal, population and multiplication of *Azotobacter* was poor primarily because of the inhibition of the water-logged conditions of the soil, and also deficiency in phosphate and trace elements. Inoculation of paddy seed could be done to correct matters and this was found not to impair the seed viability. Population of *Azotobacter* was found to increase gradually with the age of crop.

Phosphate Economy. Studies on phosphate reversion (Nilgiris, Nanginad) and their availability to rice in Andhra and Madras were in progress. It was noticed at Bapatla, that phosphate application by broadcast and mixing with soil gave significantly higher yield than localised placement at three or six inches depth. With regards to the uptake of phosphate at different periods of growth, it was observed that the uptake at 30 days was the maximum. Studies in Madras showed that,

green manuring through sesbaniac, pillipesara and dhaincha gave significantly high yields and among them the dhaincha was best. Indirect application of phosphate through green manure benefited the crop bonemeal also was effective for this purpose.

Studies at Nanjinad showed that the effect of super and dicalcium phosphate was almost equal, but superior to rock phosphate and bonemeal, on potato.

Micro-Nutrient Studies. There is an urgent need for locating the micro-nutrient deficiencies in Indian soils. The Indian Council of Agricultural Research has therefore, sponsored schemes to study the role of micro-nutrients in soils and their relations to crop production. Soil surveys have indicated deficiency of micro-nutrients in Bansakantha, Mehsana, Panchamahar and Baroda (Bombay) and Nasik and Thana (Bombay). Available molybdenum was low in west and east Khandesh and Ahmednagar (Bombay), Mehsana and Bansakantha (Bombay) while cobalt was inadequate in Baroda and Panchamahar.

Micro-nutrient studies conducted during the last three years on eight Government farms in composite Bombay State showed crop response ranging from 10-90 per cent with the application of the required micro-nutrient. Similar studies were conducted in Kulu, Palampur, Gurdaspur, Jullundur, Ludhiana, Patiala, Hansi etc., on wheat, maize, *ber*, apple and tea during last two years. Significant increase in yield of wheat ranging from five to eight maunds per acre have been obtained at Palampur by the application of zinc, boron, manganese, and copper over NPK. Zinc and copper sprays brought about 60 maund increase per acre in the green fodder of berseem at Gurdaspur. Application of micro-nutrients along with NPK had a marked effect on the growth and bearing of apples too. Chlorotic leaves of citrus plants were invariably lacking in zinc, and there were indications of the iron deficiency also. In field experiments zinc and iron sprays were found to be effective in curing chlorosis of citrus. Though, there was no increase in the yield of green tea with the application of micro-nutrients, there was an indication of the improvement of the quality of tea.

Other Studies. Schemes on the techniques of application of manures such as foliar application of nutrients to crops, application of liquid ammonium, humification of organic matter in the soil, use of soil conditioners have been in progress and have brought out indicative results which are being confirmed. The study on the behaviour of fertilizers in the storage have provided data regarding the optimum storage period and the best containers for different fertilizers. Study of fertility index and related phenomenon, the standardization of methods of soil analysis are being conducted at the field research laboratory under Dr. A. N. Puri at Bombay and the determination of soil surface area in the Punjab University laboratory at Hoshiarpur.

TUBER CROPS

At the last Tuber Crops Committee meeting held at Simla in June, 1959 a recommendation was made that a separate Tuber Crops Section which could bestow exclusive attention to these most important subsidiary foodcrops should be set up in the States. This proposal is being followed up. Meanwhile, improvement of

these crops is being sought through *ad hoc* research schemes in some of the States, the work, however, being mainly concentrated on sweet potato and tapioca which are grown on a commercial scale. In Madras V_{22} , V_8 , B 219, V_{12} and V_6 among the sweet potato varieties tested have emerged as the most promising for extended cultivation in that tract. In Kerala State, on the other hand L. 12, L. 32, F.A. 17 Red, Poona 3, Delhi 6 and American 7 are being recommended. In tapioca, Malavella has stood out as the best among those tested in Madras State and is expected to replace the erstwhile types in cultivation. In Kerala State hybridization work has resulted in four very promising triploid strains and their clones have been placed under field trials.

In the research on miscellaneous tuber crops, one notable achievement to the credit of the Kerala University is the successful growth in culture of colocasia seeds from diploids which were so far considered to be sterile, and thereby obtaining of healthy seedlings.

VEGETABLES

Vegetable crop improvement to meet the country's requirements has been in progress for past many years under a co-ordinated scheme of research functioning in Madras, Andhra Pradesh, Punjab, West Bengal, Madhya Pradesh, Bombay and Uttar Pradesh States. At all these centres improved selections and strains in the commercially grown vegetables such as *bhindi*, brinjal, tomato, cabbage, cauliflower, beans, gourds, leafy vegetables, etc., have become available for distribution as a result of the work in the previous years. In the year under report, Madras has reported on four tomato selections with yield ranges between 18,317 and 24,154 lb. per acre. H. 204, being the highest yielder. In brinjal, again S.M. 6 with a yield of 11,826 lb. per acre is reported to show an increase of yield of 32.4 per cent, over the locally grown type. In West Bengal, the problem of maintenance of stock seeds of caged plants of cabbage and cauliflower is claimed to have been solved by employment of bumble bees as pollinators. In Uttar Pradesh, an outstanding introduction was the Pan America tomato. In Andhra Pradesh an optimum spacing for the Marglobe tomato to obtain the maximum yields was determined to be $2' \times 2'$.

Research on onion in two of the States where the crop is of considerable commercial importance made steady advance. At Kodur in Andhra Pradesh, in addition to selecting the Ballary Big variety as the best to grow, planting of seedlings in preference to bulbs at a spacing of 2 in. $\times$ 4 in. on ridges was determined to be the optimum cultural practice. In West Bengal an *Alternaria* resistant type—Red globe—Bunch type (WB/OG-I) was isolated from the Saurashtrian collections.

FRUIT CROPS

Mango. The mango is being cultivated from time immemorial under different climatic and soil conditions, the data on the right type of rootstocks, manurial schedules, the proper time of ripening, picking and the methods of packing and storage, have not been scientifically worked out. Information on blossom biology, shedding of flowers and fruits is also lacking. With a view to solve the various

problems in this important fruit, a co-ordinated scheme for intensification of research on mango has been initiated by the Indian Council of Agricultural Research and is in progress in Uttar Pradesh, West Bengal, Andhra Pradesh and other centres. The various aspects of mango cultivation under different climatic conditions of the country will be investigated. The investigations are so far in the preliminary stages.

Banana. In order to tackle the numerous problems for the improvement of banana in different parts of the country, the Council has initiated a co-ordinated Banana Research Scheme with its Central Station at Aduthurai (Madras) and two sub-stations at Poona (Bombay) and Chinsurah (West Bengal).

At the Central Banana Research Station, Aduthurai, work on fundamental aspects is being carried out. Hybridization work is in progress and the hybrid progenies are under study. In ratooning of bananas, growing of two or three ratoon crops after a planted crop was found to be profitable. Root studies in Monthan and Poovan varieties and fruit development studies in Rasthali are underway.

At the Ganeshkind Fruit Experiment Station, Poona, investigations are underway to study the varietal, cultural, agronomical, ripening, packing and transportation aspects. Studies also include comprehensive breeding programme for resistance to diseases.

Preliminary observations on the study of plantation practices have revealed that both the treatments, viz., one in which one follower was maintained for four months after the planting of mother plant, and the other one, in which two followers were maintained, were both found to be useful.

At the sub-research centre, Chinsurah, West Bengal, it was found that the combined application of K and P to a dose of 8 oz. of N from inorganic source gave significantly greater height than treatments with 8 oz. of N, half from organic and half from inorganic sources with or without 8 oz. of P. The varieties under study for different cultural and manurial treatments are Champa and Kabuli. With closer spacing, higher number of suckers per clump are produced and they have the tendency to grow taller. Other varieties are being studied under varietal trials.

Work of varietal collection, ratooning, cultural trials is in preliminary stage at Tanuku in Andhra Pradesh.

As a result of three years of work on the chlorosis disease of banana in Bombay State it has been found that the incidence of chlorosis disease can be minimized by adopting controlled measures such as systematic roguing of diseased plants and stools as and when noticed, destroying affected plants and using disease-free suckers.

Citrus. Of late, citrus industry has received a great set back on account of the occurrence of the disease die-back specially in South India. The citrus industry has been threatened to be exterminated if proper remedial measures are not adopted. An I.C.A.R. scheme for investigating into citrus die-back disease is in operation at Gonocoppal (Coorg, Mysore State), Srirampur (Bombay State) and the Indian Agricultural Research Institute, New Delhi.

At the Coorg centre, experiments are being conducted, on Mandarin oranges. The problem is being tackled from manurial (major and micro-elements),

virological and rootstock points of view. The indications, so far, are that there is a greater response to certain micro-nutrients like zinc and copper and there is a variation in the intensity of disease on various rootstocks. Secondary indications are that the problem may be pathological and entomological in nature. The presence of viruses is not completely ruled out.

In the Bombay State, studies carried out so far have definitely proved the presence of number of virus diseases. The decline of trees is considered likely from virus disease as well as footrot, attack of various stem eating insects and drastic practice of root pruning. The trees affected by general decline were also found to contain low content of potash and phosphorus. Even the healthy trees were also found to be the carriers of *Tristeza* virus. The results suggest the use of nucellar seedlings as scion along with some suitable rootstock to control the citrus die-back. The performance of Rangpur lime as a stock has been found to be outstanding so far.

At the Indian Agricultural Research Institute, New Delhi, investigations were continued for finding out the description and reproductibility of symptoms of die-back due to deficiency as well as excess of micro-elements. In Mandarin orange and other rootstocks with manganese deficiency, the observation made in 1958 confirmed that the time taken for the appearance of the characteristic symptoms varied inversely with the rates of growth of stem girths of plants.

Symptoms of zinc deficiency could be produced for the first time. The characteristic symptoms of boron deficiency viz., vein enlargement, splitting the corky formation appeared in Mandarin orange. Of all the rootstocks studied, sour orange developed the typical symptoms quite prominently and in the shortest time. Continued deficiency of calcium, potassium, magnesium and phosphorus resulted in production of die-back symptoms.

Experiments to study the effects of combined deficiencies of calcium and phosphorus; and calcium and magnesium indicated that, wherever, calcium was one of the deficient elements, symptoms characteristic of this deficiency predominated.

Spray of zinc sulphate proved beneficial in mitigating the symptoms of chlorosis and die-back in *malta* and *santra* species at the I.A.R.I., New Delhi. Studies to see interaction between major and minor elements were continued. Chemical composition of the foliage from cultures of Mandarin orange under deficiencies of major nutrients in addition to revealing a very low content of the deficiency element indicated an abnormal build-up of other elements.

Chemical analysis for major elements in the leaves collected from healthy and diseased orchards at Agartala (Tripur) revealed a deficiency of calcium, potassium and nitrogen.

Root Stock Trials. Under the Citrus Fruit Research Scheme, Angul, sour orange rootstock, which was once supposed to be the best rootstock for citrus, proved to be a failure. Investigations for finding out a suitable rootstock for citrus are under way.

At Kodur, the citrus rootstock trials for finding out the best rootstocks for sweet oranges, limes and lemons are in the seventh year. In Sathgudi and acid limes, budlings on *jamberi* have recorded better growth than other rootstocks. In Nepali oblong lemons, the trees on acid limes lead others in growth character. Acid

lime buildings on Gajanimma rootstock recorded higher cumulative yields by number and weight; and appeared to be more resistant to dry-root-rot disease than other combinations.

Description of Varieties. Under the headquarters scheme 'Description of important varieties of fruits grown in India' the work on description of citrus varieties was continued. In all, 35 varieties of citrus were described in respect of floral characters, and 68 in respect of fruit characters. Analytical studies were undertaken of fruit juice of the various varieties to determine the total soluble solids, sugar-acid ratio and the percentage of juice.

Control of Fruit Pests. Intensive investigations for the control of fruit pests in Andhra Pradesh were carried out under the I.C.A.R. scheme. Two species of fruit sucking moths, *Othresis fullonica* and *O. materna* have been recorded. In Sathgudi trees, spraying with D.D.T. 0.32 per cent showed reduction of infestation by fruit moths by 44.7 per cent as compared to control. Spraying just before or immediately on the appearance of moths on the ripening fruits proved successful. Results of the studies in the chemical control of the citrus leaf miner indicated that Endrin, 0.021 per cent and Matasystox, 0.04 per cent controlled it successfully.

In all, 92 gardens of Sathgudi and acid lime were surveyed with a view to see the conditions favouring root-rot. The findings of the survey reveal that the type of material, age of the plantation, nature of soil and drainage, defective cultural operations like manuring and irrigation, nematode infestation, micro-organisms like *Fusarium* sp., *Rhizoctonia* sp. and *Diplodia* sp. and also possibly a virus complex—all seem to exercise their cumulative effect on the incidence of root-rot.

Manurial Trials. The investigations on manurial requirements of citrus, which is an important fruit crop in Punjab, were started under a comprehensive scheme of manurial trial at the Fruit Experiment Station, Attari, Punjab. It has been observed that farmyard manure, ammonium sulphate gives the best results both for cropping and vigour of the trees. As a result of these trials, it has been found that two pounds of N (half from ammonium sulphate and half from F.Y.M. i.e., from five pounds of ammonium sulphate and about 200 pounds of F.Y.M. respectively), divided into two doses, first dose of $2\frac{1}{2}$ lb. of ammonium sulphate and 200 lb. of farmyard manure applied in December to January and the second dose of $2\frac{1}{2}$ lb. of ammonium sulphate applied four weeks after the fruit set, has given good results. This dose is now being recommended to the fruit growers in that area.

Guava. The guava, known as the poor man's fruit, is a very adaptable and yields satisfactory crops under a diversity of soil and climatic conditions. In order to get the complete information on suitable varieties and cultural schedules of this fruit a sub-station on guava has been started at Basti (U.P.). Varietal collection and trials to regulate cropping in Allahabad Safeda, Red fleshed and Lucknow-49 are in progress there.

Wilt in guava is a serious disease in West Bengal. In order to find out its causes and remedial measures, a scheme has been initiated there. The studies have been confined mainly to the physiology of the pathogens, viz., *F. solanii* and *R. bataticola*. Trials on disease incidence in relation to soil moisture, organic and inorganic manure under field conditions have been undertaken and are still under observation.

A serious disease of guava was reported from Pushkar area in Ajmer. The disease is manifested by interveinal leaf chlorosis, reduction in leaf size, suppression of growth and die-back of branches. Foliar sprays of zinc sulphate (1 lb. in 16 gallons of water containing 0.7 lb. of hydrated lime) gave the best results. Soil application of ZnSO_4 (8 and 12 ozs.) was also found to be useful although the reaction was slower than the spray.

Ber. The *ber* is generally classed as a wild fruit but there are several varieties which yield fruits of marketable quality and are worthy of cultivation.

Comprehensive Scheme for Development of Ber. A comprehensive scheme for the improvement of *ber* fruit has been initiated in different States in the country.

In Madhya Pradesh, seedlings of *Zizyphus xylocarpus* have been raised for rootstock trials. A tree of variety Gol has been marked for taking scion material. The varieties Gol Banaras, Kharki and Badami were added to the collection block.

In Punjab, the rootstock trials continued. No significant difference between the percentage of success of budding operations of 'Umran' scion on different rootstocks, was found. Morphological characters and physico-chemical analysis of most of the *ber* varieties collected at Bahadurgarh were recorded.

Papaya. A major problem with papaya fruit is the production of too many unproductive male trees. In order to find a solution to this problem in the fruit, under the Coorg Fruit Research Scheme, Mysore State, a strain of Honey-dew papaya has been spotted and has been named 'Coorg Honey-dew'. This strain has a unique character, i.e. flowers borne are cent per cent females or are hermaphrodites. This is being distributed to other experimental stations in India for further trials.

Date-palm. With the partition of the country, India has been deprived of all the date growing area. In order to give a fillip to this fruit in areas suitable for its cultivation, a co-ordinated scheme for the improvement of date-palm has been sanctioned with the main station at Abohar, Punjab, and with sub-stations likely to be established in Rajasthan and Kutch (Bombay) in due course of time. The scheme aims to tackle all the problems connected with the cultivation of date-palm. At present the main work relates to the collection of off-shoots of the superior varieties, both indigenous and exotic.

Grapes. Though considered to be a fruit of the temperate zone, the grape is being grown with marked success in many parts of South India. The Anab-e-Shahi of Hyderabad, the Bangalore Blue of Mysore, the Bhokari and Phakdi of Bombay and the Seedless Kishmish of the Madurai district are well known. It was considered desirable to keep a collection of cultivated and wild species.

Eleven wild species of Vitaceae were added to the collection maintained at Agricultural College, Coimbatore, during the period under report. Morphological descriptions of these species were recorded. Based on the comparative morphology of different species, it can be concluded that the two species of *Ampelocissus* viz., *A. latifolia* and *A. tomentsa* are closely related to the cultivated grapes.

The somatic chromosome numbers in *Ampelocissus araneosa* ($2n=80$), *Tetragium muricatum* ($2n=44$), *Cissus repanda* ($2n=24$) and *Leea macrophylla* ($2n=24$), *L. sambucina* ($2n=24$), *L. robusta* ($2n=24$) and *L. aspera* ($2n=48$) were determined

for the first time. Further, *A. araneosa*, *T. muricatum* and *L. aspera* have been established to be tetraploids. The diploid chromosome numbers in six varieties of grape and *Parthenocissus* sp. (*Parthenocissus quinquefolia*) were determined to be 38 and 40 respectively.

Pineapple. Pineapple is a popular fruit grown commercially on the west coast of Kerala State. In order to recommend suitable varieties and practices to the growers, varietal collection, propagational studies and experiments on multiplication of planting material, have been undertaken in the Kerala State.

Cashew. Though classed as a wasteland crop, the cashew responds to care. Some insect pests were reported to attack this fruit. Under an I.C.A.R. scheme, two new and important pests of cashew, i.e. 'the shoot and blossom webber' and 'fruit borer' were noted in Andhra Pradesh. The insects are being checked for confirmatory identification.

Research aimed at effecting cultural improvements of this dollar-earner crop continued to be in progress in Mysore, Kerala, Andhra Pradesh and Bombay States. Trials on spacing, pruning, training, manuring, irrigation, etc., were pursued. Hybridization to bring together various desirable tree and nut characters now widely dispersed into a few easily recognizable forms and the performance study of clones of elected high yielding parents also formed major items in the programme of work.

Sapota. Sapota, an important crop of Andhra Pradesh, was reported to be attacked by Sapota bud worm. Under an I.C.A.R. scheme, the studies on chemical control have indicated that spraying D.D.T. at 0.32 per cent may prove advantageous in controlling the pest.

Temperate Fruits. Kashmir occupies an ideal place so far as the cultivation of apple is concerned.

Under the Fruit Research Scheme, Kashmir, work is in progress on varietal trials, choice of rootstock for apple, systems of training and pruning, the cultural schedules and hybridization work on apple which also includes selection of promising bud mutations. The work on hybridization is being carried out with the object of evolving varieties more juicy and melting and less compact than Ambri and less sour than Versified, red colour also being one of the considerations. For this purpose, hybridization is being attempted using Ambri $\times$ Versified parents and Red Delicious and Api Rouge.

Growth Regulating Substances. Growth regulating substances have played an important role in horticulture during the last quarter of a century. In order to study the application of growth regulating substances in horticulture, a co-ordinated scheme was started a few years back, at different centres in the country.

At the Punjab centre, work is in progress to explore the possibilities of utilizing growth regulating substances in controlling the growth and fruiting phenomena of some important horticultural crops, for example, mango, citrus and apple. Some of the specific problems being tackled are thinning or setting of fruits, arresting pre-harvest fruit drop, production of parthenocarpic fruits and control of irregular bearing. Studies are also underway to investigate the use of growth regulating substances for prolonging the storage life of fruits. Since the trials are yet in a preliminary stage it is not possible to make any definite recommendations.

At the Andhra Pradesh centre, trials were made to increase fruit set and reduce seed content in different varieties of mango, citrus and guava. Some chemicals like Indole acetic acid, Indole butyric acid, 2, 4-D and D. NAA at concentrations varying from 5 to .5 ppm. are showing promising results. Investigations to prevent early fruit drop, pre-harvest fruit drop, prolonging the harvest period by application of hormones in different commercial fruit are showing satisfactory results. In weed control, the broad leaved weeds and monocots were killed by the high concentrations of Spontox, Dicotox and Fernoxone.

Physiological studies on factors governing root formation in cuttings and layering of fruit trees are being undertaken at the Calcutta University. Indole butyric acid has shown promising results in the rooting of cuttings of lemons and limes. In mangoes, application of 5,000 ppm. in lanolin to air layers in June has resulted in profuse rooting in 4 per cent cases. Jackfruit responded well to the application of IAA, IBA and NAA in formation of roots in layered shoots. Studies are also underway on the total and reducing sugar contents in wood of mango and mulberry cuttings during root formation stages.

All India Fruit Shows. In order to bring to light the various varieties of fruits grown in the country for the benefit of fruit growers, plant breeders and horticultural research workers a scheme for holding of All-India Fruit Shows was started in the year 1956.

During the year, All-India Fruit Shows in respect of fruits like apple and mango for the Eastern Zone were held. About 2,500 exhibits received from different States were displayed in these shows. The shows are proving useful in focussing public attention to the importance of fruits and bringing out outstanding varieties of different fruits for further propagation.

At the Multicrop Fruit Research Station, Periyakulam, collection of different varieties of fruits like mango, pineapple, guava, grapes, pomegranate and figs have been made for cultural trials.

ORNAMENTAL GARDENING

Although a great deal of laudable effort stands to the credit of amateur ornamental garden enthusiasts in India for introduction, isolation and selection of a host of ornamental plants both perennial and annual including flowering species, interest in systematic scientific floricultural research is of comparatively recent date. The I.C.A.R. has been mainly responsible for the effort to evoke enthusiasm in this subject among the States by the constitution of a separate floricultural committee. Almost the very first task which this committee took upon itself was the formulation of a co-ordinated scheme for the development of floriculture in the States on a regional basis. This scheme is under active consideration of as many as eight States among which Andhra Pradesh has already commenced work.

Another scheme intended for the maintenance and propagation of seeds and bulbs of imported ornamental plants has also been formulated by the I.C.A.R. and forwarded to the States for their consideration.

Other activities in this field which deserve mention are the institution of schemes for providing financial assistance to deserving agri-horticultural societies

and to outstanding nurseries for protecting their valuable collections, and another for assessing the magnitude of the 'cutflower' industry in India with a view to see how it could be further developed.

During the year under report, at the I.A.R.I. in a scheme for cytogenetical and physiological studies in relation to floriculture, several of the experimentally produced tetraploid ornamental plants were found to maintain their 'gigas' expression in respect of flower size, etc., and also to breed true to their increased chromosome number. The radiation-induced mutant characters which made the flowers considerably more attractive were found to be genetically determined, pointing thereby to the possibility of developing strains incorporating the new characters.

SPICES AND CONDIMENTS

There was a steady progress in the research on spices and condiment crops during the past year. Chillies which are grown extensively in the southern States continued to receive attention under a co-ordinated scheme. At the I.A.R.I., Delhi an indigenous variety Puri Red exhibiting field resistance to the mosaic virus disease was used for extensive back-crossing with the agronomic base NP 46A and the F_2 seeds were now under test against this disease. At the Agricultural Research Station, Lam in Andhra Pradesh, C.A. 452-1 giving 19 per cent extra yield over the local and bearing attractive pods with bright leathery pericarp was being released to replace the erstwhile improved selection G. 2 in the rainfed regions of the tract.

Turmeric Research Scheme. Under the Turmeric Research Scheme at Guntur in Andhra Pradesh a 67 per cent higher yield has been obtained by adopting the 'Broad-Ridge' method of planting the rhizomes on ridges four feet wide and rows spaced 12 inches apart as against the local ridge and furrow method.

At Wyanad in Kerala State, an exotic introduction of ginger from China gave a very high yield of 30,000 lb. per acre in trial plots. At the same centre in comparative yield tests, Burdwan stood out with 20,115 lb. per acre as compared to a mean yield of 15,053 lb. per acre recorded by eight varieties included in this trial. Both at this centre and under a scheme in operation at Nayabungalow in Assam, it has been confirmed that early planting in the first half of April results in high yields and is being recommended as an improved farming practice for this crop. It has also been determined at Wyanad that green leaf mulching at 15,000 lb. per acre promotes yields.

Diseases of Spices. The eradication of kattee-disease affected clumps in cardamom estates formed the major activity in schemes for rehabilitation of this important spice crop. As many as 27,500 infected bushes were rogued and 35,761 healthy seedlings were planted in the Mysore State during the year.

The main centre for research on pepper continued to be Panniyur in Kerala State where the work has been in progress since 1949. It was both of interest and practical significance to observe that several among the 1,547 hybrid seedlings involving 25 parental combinations had produced spikes within an unusually short period of two and a half years after sowing the seed and also combined in

themselves the desirable characters of the parents. Another finding of some importance was that 'Pollu' or hollow-berry caused by the pepper flea-beetle could be controlled by regulation of shade over the plantation and spraying the vines with 0.125 per cent D.D.T. every month from July to October.

ESSENTIAL OILS

Selection and breeding of essential oil-yielding plants like 'ajwain' (*Trachyspermum ammi* L.), 'dhania' (*Coriandrum sativum* L.), 'saunf' (*Foeniculum vulgare* Mill) and 'sowa' (*Anethum* sp.) for high yields and high oil content continued to engage attention at the I.A.R.I., Delhi with sub-centres for work in Bombay, Bihar and Punjab States. Improved selection were isolated and placed under field tests before their release as strains. A study of floral morphology and embryology of some of these species was also in progress at Delhi University.

DRUGS AND MEDICINAL PLANTS

Recent years have been marked by growing interest in the possibilities of cultivating medicinal plants yielding pharmaceutical drugs for which our dependence on foreign sources is known to entail the investiture of an appreciable amount of foreign exchange annually. Medicinal plant research, therefore, continued to engage the attention in schemes operated in Jammu, Dehra Dun and Rongo. At Jammu, a new successful introduction was the Ammi-visnaga from Egypt whose fruits are used for the preparation of khellin, a reputed medicine for asthma. At Dehra Dun, an average sample of roots of *Rauwolfia serpentina* from a bulk collection on analysis gave 0.12 per cent of reserpine which is among the highest reported for the spices. Investigations on the cultural aspects of Ipecacuanha have gained topical importance in the context of the vast extension of area under this crop being undertaken by the Government of West Bengal and experimental centres at different elevations ranging from 1,300 ft. to 2,800 ft. were set up for determining the optimum cultural requirements of this crop.

The possibilities of producing ergot successfully and economically in the country were being explored in two schemes working in Assam and West Bengal. Maximum infection of the rye crop with *Claviceps purpurea* at the Assam Centre was obtained by spraying the inoculum between the 17th and 19th days after emergence of the earhead.

A scheme of research on camphor tree cultivation with particular reference to its manurial requirements, optimum season for camphor extraction and the stage of development of the leaf at which the camphor content would be maximum was initiated under a co-operative endeavour between a private plantation in Wyanad and the Department of Agriculture, Kerala State.

AGRICULTURAL IMPLEMENTS

The I.C.A.R. has sponsored several schemes of research and developmental nature to overcome the set-back suffered by the agricultural industry due to lack of proper implements.

Under the scheme for production, demonstration, trial and popularisation of improved agricultural implements, 116 implements and machines, e.g., Rice land weeder, Grain screen machine, Bullock drawn seed drill, Orissa plough, Pedal operated paddy threshers and Olpad threshers, etc. were supplied to 14 participating States who have tested them under local conditions. The test reports have been received and are under scrutiny and compilation at the I.A.R.I. As a result of this study, arrangements will be made to manufacture the most promising ones in this country.

The Austrian Trade representative in India had offered the services of two experts for training farmers in the use of Austrian scythes in India for period of two years on the ground that these scythes were far more efficient than the sickle. It was decided by the Council that, in the first instance, about half a dozen scythes may be procured for trials so that the possibilities of their adoption in India may be explored. Accordingly a set of six scythes was obtained from the Austrian Legation. Necessary trials were carried out on these scythes by the Agricultural Engineering Division, I.A.R.I. As a result of these tests, it has been decided that similar experiments should also be carried out with these scythes in the States for certain specific crops. Arrangements have been made to procure 30 sets of six scythes each through the Austrian Legation. These, when received, will be distributed to the States for trials.

Survey of Indigenous Agricultural Implements. The Survey has been completed in all the States and the All-India Report of the Survey has been compiled on the basis of the State reports of the survey. The All-India Report of the Survey is in the process of being printed. This report will indicate the lines on which further research work may be carried out on different implements.

It was noted that some implements, such as, water lifts, chaff cutters, ground-nut decorticators, rice processing equipment, bullock carts and threshing devices etc., were not included in the previous survey. A co-ordinated scheme was, therefore, sanctioned for the States for one year, from 1st April, 1958, and at the I.A.R.I. for two years also from 1st April, 1958. Due to the delay in the appointment of regional officers, the scheme could not be started earlier. Arrangements have now been made to collect the data through the State Agricultural Engineers, pending recruitment of regional officers.

Trial of Imported and Improved Implements. The object is to evolve efficient and labour saving agricultural implements for various agricultural operations in the States from the available improved agricultural implements in different parts of India and other foreign countries. Copies of the approved proforma regarding selected 14 implements viz., terraces and hand operated maize sheller, etc., have been supplied to the concerned States with the request that their requirements of different implements may be communicated to the Head of the Division of Agricultural Engineering, I.A.R.I. to enable him to take steps for the procurement of the required implements and machinery and for supply thereof to the States for trials.

Research-cum-Testing Centres for Bullock-driven Implements. A Regional Research-cum-testing Centre has already been started at the I.A.R.I. Necessary sanction for another such centre at Coimbatore has also been conveyed to the Government of

Madras. It is proposed to establish the third centre in Bombay and the fourth centre in West Bengal in 1960-61. The object of the Scheme is to design and test bullock-driven agricultural implements under actual field conditions and to suggest improvements therein to increase their efficiency.

PIRRCOM (MILLETS)

The Project for Intensification of Regional Research on Cotton, Oilseeds and Millets (PIRRCOM) has been jointly sponsored by the I.C.C.C., the I.C.O.C. and the Indian Council of Agricultural Research. Under the project, nine main centres and eight sub-centres have been established in different parts of the country. Six centres out of these started functioning in 1959-60. The main object of these composite regional research centres is to organize agricultural research on a cross-commodity basis and to deal with the agricultural problems on a regional basis. The main centres and sub-centres with their main crops for investigation are given below:

A. Main Centres. (1) I.A.R.I., Delhi (*jowar*, *bajra*, cotton and linseed); (2) Kanpur, U.P. (*bajra*, *rai* and *sarson*); (3) Sirsa, Punjab (*bajra* and cotton); (4) Coimbatore, Madras (cotton, groundnut and *bajra*); (5) Amravati, Bombay (*jowar*, cotton and groundnut); (6) Surat, Bombay (*kharif* *jowar* and cotton); (7) Dharegur, Mysore (*kharif* *jowar* and cotton); (8) Hyderabad, Andhra Pradesh (oilseeds) and (9) Patiala, Punjab (oilseeds).

B. Sub-centres. (1) Junagarh, Bombay (*jowar* and groundnut); (2) Mohol, Maharashtra (*jowar*); (3) Sulekere, Mysore (*ragi* and groundnut); (4) Bellary, Mysore (*rabi* *jowar*); (5) Dharwar, Mysore (*kharif* *jowar*); (6) Gwalior, M. P. (*kharif* *jowar*); (7) Hoshangabad, M. P. (linseed); and (8) Ajmer, Rajasthan (*bajra*).

Work at the main centres at Amravati, Surat, Dharegur and in sub-centres at Dharwar and Mohol has started very recently. Studies on the physical nature and chemical content of the soils were undertaken in the different main and sub-centres as preliminary to field studies.

Studies on *jowar* and *Bajra*. Botanical studies on *jowar*/*bajra* have been started at the main centres at I.A.R.I. and Sirsa and at the sub-centres at Ajmer, Gwalior, Mohol and Bellary. It was observed that the Bombay types of *rabi jowar* such as M.47-5, M.35-1 were significantly better yielding than the Hagari types at Bellary Centre.

Rotational-cum-manurial trials, mixed cropping and other agronomical studies were made with *bajra*, green gram and *guar* at Sirsa and the data awaits confirmation. In the sowing time and spacing tests at Bellary from the point of view of grain yield, third week of October was found to be the best time for (drill) sowing *rabi jowar* and 18 inch spacing between the rows was the most profitable practice.

Studies on Oilseeds. The Botanical studies were initiated on *toria* and *taramira* at Patiala and on groundnut and castor at Hyderabad.

Rotational, inter-cultural and weed control investigations were undertaken on groundnut and castor at Hyderabad. It was found that, two inter-cultivations

would maximise the groundnut yield rather than one or three. The average increase in the yield of weeded over non-weeded erect variety of groundnut (i.e., TMV. 2) was over three maunds of dry pods per acre. In the spreading variety, on the other hand, the yield was poor and the advantage in weeding was not also appreciable.

Studies on the effect of manuring, irrigation and disease on the oil content of *sarson* were made at Kanpur. Irrigation increased oil content and manuring and disease (*Alternaria*) decreased it. Irrigation did not affect protein content, but manuring and attack of disease (*Alternaria*) increased it. Trials on *toria* at Patiala indicated the advantages in manuring upto 60 lb. N and 40 lb. P_2O_5 for better yield. Insect pests and diseases of castor and groundnut were studied at Hyderabad. Attack of groundnut aphids was very severe particularly during July-August and some insect enemies of this insect were noted for eventual utilization. Similarly, among the diseases of groundnut Tikka leaf spot, though not serious, was seen to affect the erect variety T.M. 2 more than the spreading TMV 3.

Studies on Cotton. Botanical investigations on cotton were taken up at Sirsa and Coimbatore. Five American types in the Coimbatore collection were found to possess long staple with mean fibre lengths of 1.03 inches to 1.11 inches and this is being studied along with other promising extra staple varieties. Similarly, out of three Russian varieties tried, one i.e., C. 1998 was found to be highly productive (with a *kapas* yield of 1,202 lb. per acre) equal to MCU-1 in most of the other economic characters and adaptable under Coimbatore conditions.

Agronomical investigations on cotton were taken up at Sirsa. The best yield of cotton was obtained with 50 lb. N of ammonium sulphate and 50 lb. P_2O_5 applied at the time of flowering or drilled at thinning. The yield of *kapas* increased upto 75 per cent over control with the increased dose of nitrogen from 20 to 100 lb. per acre as ammonium sulphate. As to the mode of application of N and P, spray application of 25 lb. N and 5 lb. P_2O_5 was more economical and effective than soil application. But, in the case of higher doses, it was more advantageous to apply half in foliar spray and the other half in the soil. Similarly, in the micro-nutrient, spray application of manganese gave about 15 per cent more yield of *kapas* than the unsprayed. In the irrigation-cum-manurial trial, seven irrigations of two and three inches gave the highest yield.

Investigations were taken up on the pests and diseases of the crop at Sirsa and Coimbatore. Spraying Endrex or dusting Sevin (at ten days' interval) for controlling cotton pests gave extra yield of two to five maunds of *kapas* over untreated at Coimbatore.

COCONUT

The Central Coconut Research Stations at Kasargod and Kayangulam continued research work on introduction and study of exotic varieties of coconut, hybridization, cultural and manurial experiments and investigations on coconut pests and diseases. Regional coconut research stations are functioning in Kerala, Andhra Pradesh, Bombay, Assam, Madras, Mysore and Orissa. Sixty-seven coconut

nurseries with a production target of nearly nine lakh seedlings per annum have also been functioning. A survey of coconut growing tracts to find out promising varieties was also undertaken. A soil survey to determine tracts suitable for growing coconuts has also been initiated.

Studies on storage of copra and coconut oilcake and experiments for extension of the duration plaited coconut leaves are in progress.

Zonal stations to breed parasites of the pest *Nephantis serinopa* were in operation in the States of Kerala, Madras, Andhra Pradesh and Bombay. Schemes for investigation and control of coconut diseases were in operation in the States of Andhra Pradesh and Mysore.

Pilot surveys for correct estimation of the area and yield of coconuts was initiated in the States of Kerala, Mysore, Madras, Andhra Pradesh, Bombay, Orissa and Assam. The Regional Research Laboratory in Hyderabad started work on preparation of activated charcoal from coconut shell and another for the solvent extraction of coconut oilcake.

Schemes for coconut development and extension were in operation in the States of Madras, Mysore, Andhra Pradesh, Bombay, Orissa, West Bengal and Kerala. In Kerala State, 52 lakh of sprayings were done during the year under review.

ARECANUT

The year under report recorded an all round progress in arecanut research, development and technology. The technique of hybridization was standardized. Seventeen exotic types from other regions of the world were collected for trial during the year. Various techniques for standardizing nursery practices were also being tested. Manurial experiments for determining the optimum manurial doses, its time and method of application and kind of fertilizers to be applied, were conducted. Cultural experiments were also laid out with the object of finding out best cultural treatments for getting the maximum yields. Survey on the incidence of pests and diseases was conducted. The efficiency of various fungicides against the common pests and diseases were tested. Out of the total area of 9,200 acres planned to be brought under arecanut during the second plan period, 4,000 acres are estimated to have been covered by September, 1959 using the seedlings produced from the Government nurseries. It is proposed to take up the rest of the area during 1960-61. In order to determine precise area and production of arecanut in the country, surveys were done in the States of Kerala, Mysore, Bombay, Madras, Andhra Pradesh and Assam. Schemes for West Bengal and Orissa were finalized during the year under report.

Schemes on development of co-operative marketing recorded satisfactory progress. A pilot scheme on cost of cultivation also progressed satisfactorily.

The technology unit working at the Central Food Technology Research Institute, Mysore, evolved various techniques to determine the chemical constituents present in arecanut kernel and other by-products. Techniques for the proper preservation of the nuts were also evolved.

OILSEEDS

During the year, Oilseed research, development, marketing and technology made substantial progress. On the research side, the total of 75 schemes were sanctioned out of which 64 are in operation costing Rs. 27,62,687/-. Several developmental schemes of both intensive and extensive nature, aimed at increasing the total production of oilseeds in the country were initiated. These include "Package Programme" for intensive cultivation of groundnut under which one district in each State well-known for groundnut production is selected for adopting all scientific practices for stepping up the per acre yield. Another scheme for covering the entire groundnut area in the country with improved seeds within five years has also been drawn up. Besides groundnut, other oilseeds like castor and linseed are also being multiplied and distributed in almost all the States. The area under castor is being extended in the States of Madras, Mysore, Punjab, Andhra Pradesh, Bombay, West Bengal, Uttar Pradesh, Madhya Pradesh, Rajasthan and Tripura by distributing free seed on a limited scale.

For ensuring plant protection, the Committee sanctioned 26 special plant protection units in almost all the States of the country at a cost of over Rs. 34,00,000/-. The work of developing non-edible minor oilseeds is also receiving adequate attention.

On the technological side, schemes for (i) oil analysis of improved strains, (ii) preparation of plastic edible fats by directed inter-esterification method and (iii) preparation of tallow substitutes from *mahua* oil have been sanctioned. Ways and means of propagating the utilization of the cotton seed cake as cattle feed in place of cotton seed are being explored. For encouraging the village oil industry the Committee recommended that the practice of granting interest free loans to village co-operative societies of oilmen be discontinued and instead financial assistance in the form of direct subsidy might be given in future. The Committee also decided that as the *mahua* sheller designed by Prof. Shart was an efficient implement, the same may be popularized through Community Projects and N.E.S. Blocks, by offering 25 per cent subsidy to individuals and 33 per cent subsidy to Co-operative Societies.

All-India standard contract terms for linseed were adopted by the committee. It was also decided that the statistical data regarding oil production in the country in respect of small oil producers should be collected through the Directorate of National Sample Survey as the same is not being obtained by the Central Statistical Organization. Scheme for estimating the cost of production of cotton and its rotation crops and determination of average yield per acre of the principal oil seed crops have been sanctioned in the main oilseed producing States.

COTTON

The Indian Central Cotton Committee continued to finance 55 research and 24 seed multiplication and distribution schemes in collaboration with the State Governments for the improvement and development of cotton. The research schemes aimed at the evolution of new varieties possessing superior yield and quality

compared to the existing ones and the determination of optimum conditions for maximising yields through agronomic and physiologic investigations. A few schemes were also in progress for the control of pests and diseases either through the evolution of resistant strains or through chemical means. The Committee also sponsored seed multiplication and distribution schemes to promote the spread of almost all the existing improved strains.

The re-selections from Indo-American strains, viz., 170-Co.2-S. 1-2, 170-Co. 2-2-S.3, 170-Co.2-2-126, 68-18-3 and ISC-67 were found to be superior to the existing strains 170-Co.2 and 134-Co.2-M in yield and resistance to back-arm.

In Andhra Pradesh, the new strain 5,975 was found to yield 16 per cent higher than N. 14 in cultivators' holdings. This new strain is proposed to be released for general cultivation on confirmation of its quality through mill tests.

In Punjab, application of 0.1 per cent D.D.T., 0.1 per cent B.H.C. (Suspension) or 0.02 per cent Endrin (emulsion) at the rate of 50 to 100 gallons per acre every 15 days from July to September was found to be very effective in controlling jassids and whitefly.

The new *desi* cotton strain evolved in Uttar Pradesh, viz., U.P. No. 1, was found to be on a par with the local strain 35/1 in yield with a spinning capacity of 19's H.S.C. as against 15's of 35/1.

During the year 1959-60, an area of 3,966 acres (3,055 in Kerala and 911 acres in Mysore) was sown with Sea Island Cotton of which 2,461 acres were finally available for harvest.

TOBACCO

The Indian Central Tobacco Committee continued research on various types of tobacco at the research stations and sub-stations, besides running a number of schemes in conjunction with State Governments and other institutions under the Second Five-Year Plan.

East Godavari Area. For obtaining the maximum number of transplants, it was found that application of 100 lb. P_2O_5 per acre to the soil as basal dose, coupled with application of N in the form of ammonium sulphate as top dressing in two or three instalments was highly beneficial.

The new variety Delcrest was found to be superior to the commercially grown Harrison Special and the farmers were able to realise about Rs. 100/- more per acre by growing the variety.

It has been confirmed that the grades of top leaves of the cigarette tobacco plant could be improved by dipping the base of the leaf in water for four hours and then curing.

Malathion, Endrin and Meta-systox were effective in controlling the leaf curl of seedlings.

Guntur Area. Deep ploughing (crow-barring) the field in summer increased the yield of cured leaf of flue-cured Virginia by 50 per cent.

The two-year rotational treatment tobacco after coriander appeared to be the best.

Amongst the different forms of nitrogenous manures groundnut cake proved to be best for natu tobacco.

Vadasandur (Madras). The variety Karuvazhia proved to be a better yielder than the variety Vallavazhai.

Dinhata (West Bengal). Among the varieties of cigar wrapper tobacco tried so far, variety Dixie shade proved to be the best both under shade and exposed condition.

Schemes under Second Five-Year Plan. A scheme for conducting storage experiments was initiated at the Central Tobacco Research Institute, Rajahmundry and *Bidi* Tobacco Research Scheme, Anand. Besides, three new schemes for the establishment of exploratory research stations were started in Andhra Pradesh.

The free training in improved methods of tobacco cultivation, handling and curing at the Central Tobacco Research Institute, Rajahmundry, Institute of Agriculture, Anand and the *Bidi* Tobacco Research Sub-station, Nipani, continued.

JUTE

Agricultural Research. It was found that JRC-212 a new *Capsularis* variety was significantly superior in yield to the standard variety D.154. Anatomical studies of *Olitorius* jute plants raised by inoculating the seeds with a new nitrogen-fixing bacteria showed that fibre percentage has increased in plots having phosphate application. In the application of nutrients by foliar spray, it has been observed that urea is more effectively absorbed than ammonium sulphate. Boron, plays a very effective role in the normal growth and development of jute. It was also found that the yield of first crop (jute) is more when it is sown in April and harvested when the crop is 105 days old. Decrease in the retting period can be brought about by using (a) sunnhemp and *dhaincha* as natural activators and (b) magnesium salts particularly phosphates.

Technological Research. Technological research showed that improved cement bags made from hessian and mill waste were satisfactory under actual users' trial conditions. The book-binding cloth made from non-woven jute fabric was also found satisfactory.

Economic Research. Investigation in the economics of jute growing carried out at ten selected centres put the average cost of production at Rs. 18.17 per md. for jute as against Rs. 17.31 for mesta.

A study of comparative economics of jute cultivation by the improved and traditional methods showed that by investing 24 per cent more, the improved method was found to have given a yield 40 per cent more than the traditional method. The average cost per maund of jute by the improved method was only Rs. 16.84 as against Rs. 18.76 by the traditional method.

Development. Jute development work was carried on according to the programme of the Second Plan in all the six jute-growing States and efforts were made to step up the acre yields by use of improved seeds, fertilizers, and line sowing and check up spread of diseases by taking prompt plant protection measures.

Demonstrations on improved methods of jute cultivation were continued in the Extension Centres round the Central Station and also in the Jute Development Blocks in Bihar, Assam, U.P. and Orissa.

LAC

The production of lac during the year under review was 11,59,000 maunds, which is 69,500 maunds in excess of the period 1957-58. A comprehensive scheme for improving the collection of statistics and market information has been drawn up on the basis of results obtained from the pilot scheme for determining the average yield of lac and estimating production of lac based on random sample survey techniques.

A chain of 14 central nucleus brood-lac farms has been set up in order to overcome frequent failures of lac crop and to augment its production. The States with the financial assistance of the Centre and on their own have also set up 60 such farms for extending lac cultivation in forest areas and for helping the tribal people.

At the Lac Research Institute, Namkum, Ranchi, Bihar, experiments have shown that the effect of partial defoliation of *palas* on the preservation of brood-lac from the summer crop was found to be beneficial. Both in respect of brood-lac and stick-lac yield, *palas* was found to be better than *ber* in *Vaishakhi* season, but *ber* was found to be superior to *palas* in *Katki* seasons. Partial pruning of the *ber* plant either before or after inoculation did not in any way help in the preservation of brood-lac in the summer season. Trials conducted on *Albizzia lebbek*, *Ficus glabella*, *Ficus glomerata* showed that none of these hosts carried lac crop successfully.

CHAPTER III

Animal Husbandry Research

CATTLE BREEDING

Selective Breeding Versus Grading up. The Council has initiated co-ordinated research on this subject with a view to finding out the relative value of selective breeding of indigenous cattle as compared to their grading up with improved breeds under local climatic conditions. Schemes on this subject are operating in the States of Orissa, Bihar, West Bengal and Madras.

Under these schemes cows are divided in two random groups. One group is taken for selective breeding and the other for grading up. Female progeny born in either of the groups is rotated to bulls other than their sires. Animals in both these groups are provided proper feeding and management conditions and their breeding and performance records are maintained. These schemes have as yet not advanced far enough in all the centres to give definite answers to the problem under study. The investigations are therefore being continued. A brief Statewise description for the year 1957-58 is given below:

ORISSA

Selective Breeding and Grading up of Ghumsur Cattle with Haryana Breed. The work under this scheme started in January, 1954. During the year 105 services were performed in the grading up group on 48 cows and 14 heifers out of which in 41 cows and 12 heifers, the services were fertile. In the selective breeding group, 44 cows and 12 F₁ heifers were served by Ghumsur bulls, of which 37 and 9 services were fertile.

Body weight records of the adult stock were maintained. The average weight worked out to 409.52 lb. as compared to 377.3 lb. in the last year. During the year under report 19 F₁ males and 14 F₁ females were born. The birth weights of the graded progeny were comparatively higher than the weight of selective breed progeny by 8.95 and 4 lb. in the case of males and females respectively.

The average yield was found to be two pounds and 12 ounces. The average lactation yield for 300 days based on milk actually obtained in the pail worked out to 655 lb. and two ounces as against 1,234 lb. and 14 ounces based on complete stripping records. The cost of milk production worked out to 0.52 nP. per lb. based on normal milk yield and 0.30 nP. per lb. based on complete stripping records.

Selective Breeding of Khariar and its Grading up with Sindhi. This scheme has been in operation since March, 1956. During the year under report seven male and 16 female calves were born in the selective breeding group and seven male and five female calves were born in the grading up group. The average

weight of the adult cow was 396 lb. The birth weight of the graded male progeny was 7.3 lb. more as compared to the progeny in the selective breeding group. In the corresponding groups the birth weight difference among female calves was six pounds. Milk recording was continued and complete stripping was practised once a week. The average milk yield for Khariar cows was 764.4 lb. in a lactation of 332 days as calculated on pail yield. Based on complete stripping records the average daily milk yield per cow was 12 pounds and 5 ounces. The cost of milk production worked out to 44 nP. per lb. based on entire lactation and 40 nP. per lb. based on complete stripping yield.

BIHAR

Selective Breeding of Red Purnea and its Grading up with Sindhi.

This scheme was started in January, 1956. The experimental stock for the scheme was also obtained but the breeding programme could not be taken up fully as some of the experimental animals arrived late.

Milk recording was started. Cost of feeding of individual animal per pound of milk produced was Rs. 3.78 nP. in the selective breeding group and 1.10 nP. under grading up group.

WEST BENGAL

Selective Breeding of West Bengal Cattle and their Grading up with Haryana—Haringhata.

Work under this scheme was started in December, 1956. During this year 136 cows belonging to 14 different groups were bred. Fifty-six animals were calved, 36 in the selective breeding group and the rest in the grading up group. The average dry period during the year was 130.8 days. In the selective grading group the gestation period was 286.2 days, while in the grading up it was 285.4 days. The milk yield of the cows in the various groups was recorded according to the technical programme. Further work is in progress.

Improvement of Kangayam Breed. This scheme was started in July, 1952, with the object of improving by selective breeding and proper feeding and management the milking capacity of the Kangayam breed to its optimum without adversely affecting its draft quality.

Initially 60 heifers between the ages of $1\frac{1}{2}$ to $2\frac{1}{2}$ years born to dams averaging 2,000 lb. of milk per lactation were selected as the foundation stock. These were mated to bulls from high milk yielding dams. Once a week milk yield was recorded by complete stripping both in the morning and evening. In the progeny born in the experimental herd there were 59 animals yielding 2,000 lb. and above, 88 animals yielding more than 1,000 lb. but less than 2,000 lb. milk and 30 animals with less than 1,000 lb. yield. Ninety bulls were distributed under the various Cattle Improvement Schemes, viz., Key Village Scheme, Bull Distribution Scheme, A.I. Centres, etc.

The average age of maturity of the progeny born under the scheme worked out to 42 months with a range of 30 to 48 months. The average daily milk yield of udder massaged cows was 8.0 lb., while it was 7.2 lb. for cows whose udders were not massaged. The average fat percentage of milk was 5.2 with a range of three to six per cent.

Out of 110 calves born, half the number was male and the other half female. The average birth weight of male and female calves was 48.0 and 44.0 lb. respectively. Maximum weight of male calves was 57.0 lb. and minimum weight of female calves was 31 lb. The average daily gain in body weight of calves was 0.9 lb. and the maximum gain was 1.3 lb.

PUNJAB

Livestock Investigation Scheme, Hissar. This scheme was started in April, 1951, with the object of finding out whether by process of careful breeding and selection the two most important economic characters in Haryana cattle, i.e., milk yield and draftability, can be suitably combined to evolve a dual purpose type animal which would serve the economic needs of the country. The investigation was originally started with 230 heifers and cows and ten bulls. They were divided in ten groups and again in 1954, re-organization of the herd was done by culling out the inferior stock and regrouping of the experimental animals.

During the year under report milk yield data of 354 Haryana cows which were selected on the basis of body confirmation and had completed lactations were analysed. From this it was observed that the percentage of cows giving 2,000 lb. of milk and above had increased from 24.7 per cent (foundation stock) to 34.3 per cent (progeny) while the percentage of cows giving 1,000 lb. and below had decreased from 24.6 (foundation stock) to 5.7 per cent (progeny). The average milk yield of the foundation stock was $1,172.9 \pm 59.50$ lb. and that of first generation cows $1,463.7 \pm 49.71$ lb. These results indicate a definite improvement in the milk yielding capacity of the progeny.

Records of 674 bulls obtained since 1954 were investigated for 'service behaviour' and it was observed that the average reaction time among these varied from 2 seconds to 66 minutes 28 seconds with an overall average of 15.3 ± 0.53 minutes. Fertility studies in the experimental bulls indicated that the fertility rate did not differ much from bull to bull. On an average 55.1 per cent services were fertile. Out of 91 calves born during the year, 43 were males and 48 females. The sex ratio of the progeny calculated on the basis of 1,435 births recorded during the past 13 years worked out to 102 males to every 100 females. The average calving interval in the year under report was 514.5 ± 14.47 days as compared to 509.3 ± 15.2 days in 1956-57. The average birth weight of male calves was 52.4 ± 0.35 lb. while it was 49.0 ± 0.37 lb. for the female calves.

The heritability of milk yield as calculated by intra-sire dam-daughter regression method from the first lactation 300 days milk yield records of 130 daughters was found to be 0.51 ± 0.12 .

The rate of mortality in the experimental herd remained on the same level as it was last year, being about 3.5 per cent.

CENTRAL ARTIFICIAL INSEMINATION STATION, BANGALORE

The Central Artificial Insemination Station, Bangalore, was established as an adjunct to the Co-ordinated Scheme on Cross-breeding of Cattle with the object of supplying Jersey semen to the different units of the Cross-breeding Scheme located

in the various parts of the country. This station started functioning in December, 1954. In order to facilitate artificial insemination programmes under other cattle improvement schemes, in addition to Jersey, bulls of Sindhi, Tharparkar and Murrah breeds are also being maintained at the centre and their semen supplied on demand to the various States.

During the year under report, 204 consignments consisting of 56,980 cc. of Jersey semen, 797 consignments consisting of 37,395 cc. of Sindhi semen, 333 consignments consisting of 4,758 cc. of Tharparkar semen and 350 consignments consisting of 6,179 cc. of Murrah semen was despatched to the various States. In all cases, at the time of collection and before despatch, quality of semen was tested. Proper records about the motility of semen conception rate, etc., at the receiving stations were also maintained. In order to meet the requirements of Jersey semen of the cross-breeding schemes units located in the eastern States, a Regional Artificial Insemination Station has been established at the Tollygunj farm, Calcutta. Here two Jersey bulls are maintained and as in the case of the Bangalore Centre diluted Jersey semen is supplied to the various places.

CO-ORDINATED SCHEME ON CROSS-BREEDING OF CATTLE

The Co-ordinated Scheme on Cross-breeding of Cattle in the hilly and heavy rainfall areas continued to function in ten different units. These units are located in the States of Assam, Andhra Pradesh, Bihar, U.P., Kerala (two), Madras, Punjab, West Bengal and Manipur. In addition to these, two new units one at Coorg (Mysore State) and the other at Hyderabad (Andhra Pradesh) that were sanctioned earlier, started functioning during the year. The main objectives of this scheme are:

1. To investigate the possibility of improving milk production by introduction of foreign blood among the non-descript animals.
2. To investigate the optimum proportion of foreign blood that would enable animals to thrive and produce their best under the local climatic conditions.
3. To study the effect of packing, storage and transportation of semen on its motility and other qualities.

Under this scheme, breeding is done by artificial insemination with Jersey semen which is sent by air/rail from the Central Artificial Insemination Station, Bangalore, and the Regional Artificial Insemination Station, Tollygunj, Calcutta. The progress of work during 1958-59 under various centres was as given below:

Andhra Pradesh (*Vishakapatnam*). During the year under report 1,501 animals were tattooed; 299 scrub bulls were castrated and 802 cows were inseminated. The inseminated cows were followed up regularly. Out of 709 cows examined for pregnancy 326 were found pregnant. Two hundred and ninety-seven cross-bred calves were born. Milk recording was also taken up and 4,297 records were made.

Assam (*Shillong*). Due to various factors, the progress of work under this scheme remained slow. Seven hundred and seventy-five animals were tattooed, 129 bulls were castrated and 339 inseminations were performed. Against this 179 cows were bred by natural service. Among the inseminated cows, 58 were examined

for pregnancy out of which 36 were found pregnant. Twenty nine calvings were recorded. Milk recording was taken up and 4,365 records were made.

Bihar (*Ranchi*). Seven hundred and forty animals were marked for identification and 161 bulls were castrated. The Livestock Improvement Act has not yet been introduced. Seven hundred and forty cows were inseminated while 668 cows were examined for pregnancy out of which 318 (about 47 per cent) were found pregnant. One hundred and sixty-two cross-bred calves were born. Milk recording was taken up and 3,695 records were made.

Kerala (*Chalaky*). During the year under report, 953 adult and 248 young calves were marked for identification. Three hundred and one adult and 72 young bulls were castrated. The Livestock Improvement Act has been extended to the scheme area. A total of 1,562 inseminations were performed. Out of 1,289 cows which were examined for pregnancy, 608 were found pregnant. Two hundred and ninety-five cross-bred calves were born and 3,233 milk recordings were made.

Kerala (*Neyyattinkara*). Last year, house to house survey of the area was completed and essential laboratory equipment, etc., obtained. Subsequently, work on various items of technical programme was taken up. During the year under report, 1,361 adult animals and 68 calves were marked for identification, 72 males were castrated, 1,211 inseminations were performed, against which 517 natural services were recorded in the scheme annually. Eight hundred and ninety cows were examined for pregnancy out of which 520 were found pregnant, 187 cross-bred calves were born, and over 3,000 milk recordings were made.

Madras (*Ooty*). During the year, 320 adult and 71 calves were tattooed. The Livestock Improvement Act has been extended to the scheme area and 338 adult and 295 young bulls were castrated. Among the scheme animals, the number of inseminations performed was poor, being only 526, 336 cows were followed up, out of which 243 were found pregnant. Two hundred and sixteen calves were born among the scheme animals and 2,234 milk recordings were done.

Punjab (*Palampur*). During the year 1958-59, over 100 animals were marked for identification, 263 bulls were castrated and 422 inseminations were performed. There was some difficulty in regular supply of potent semen to this centre due to transshipment at Delhi. Necessary steps have now been taken to rectify this defect and the supply is now normal. Two hundred and forty cows were examined for pregnancy out of which 79 cows were found pregnant. Forty-one cross-bred calves were born. Milk recording was started in the main and in the sub-centres and 3,262 records were made during the year.

Manipur (*Imphal*). During the year under report this unit was taken over by the administration for being financed from its own funds. The Council, however, continues to provide technical guidance. During the year under report, 666 animals were tattooed and 468 bulls were castrated. The number of inseminations performed was small, being only 272. Two hundred and twenty-four animals were examined for pregnancy out of which 135 were found positive. Fifty-three cross-bred calves were born. Milk recording was taken up in the main and in the sub-centres and in all 4,031 milk records were made.

Uttar Pradesh (*Dehra Dun*). Last year, house to house survey was completed and essential items of equipment were purchased. During the year under report,

178 animals were marked for identification and 450 castrations and 330 inseminations were performed. Out of 162 cows followed up 114 were found pregnant, 68 cross-bred calves were born and 2,788 milk records were made.

West Bengal (*Darjeeling*). This unit came into operation in January, 1956. Due to difficult terrain and certain other factors, progress of work under this unit has been rather slow. Six hundred and five animals were tattooed and 83 bulls were castrated. Two hundred and fifty-nine inseminations were performed. Twenty-two cows were examined for pregnancy out of which 19 were found pregnant. Number of calves born was 75 and in all 2,152 milk records were made.

SCHEME FOR SPREADING OUT THE BREEDING SEASON IN BUFFALOES

This scheme started functioning from 25th June, 1958 at the Indian Veterinary Research Institute, Izatnagar with the object of finding out ways and means of spreading the calving season in buffaloes throughout the year for ensuring even supply of milk in different seasons.

Preliminary arrangements were made for starting the work and in respect of various items of the technical programmes, available data was collected from some of the Government farms.

SCHEME FOR INVESTIGATION OF CAUSES OF DEGENERATION OF CATTLE IN HUMID CLIMATE

Of the various causative factors, the more important ones requiring immediate investigation appear to be feed, parasitic infection and climate. Under this scheme in the first instance, investigation into the effect of one factor only, viz., climate on some of the important breeds of cattle is being undertaken.

Sixteen Haryana heifers of six to nine months age were transferred to Calcutta from Hissar and 16 Bengal heifers of the same age were obtained locally at Calcutta. Animals of both breeds were divided into further groups of eight each. One group of eight animals of each breed was given Bengal diet (obtained locally at Calcutta) and another group was given Punjab diet (which was obtained from Hissar at regular intervals). The diets comprised of cakes, grain and dry fodder. In addition to these four groups, another group of eight Haryana heifers fed on Punjab diet was kept at Hissar to serve as control. Salient observations made during the years were as under:

(i) There was no appreciable difference in the rectal temperature and pulse rate of various breeds and dietary groups at Calcutta. Bengal animal, however, had higher respiratory rate per minute than Haryana animal.

(ii) Actual food and water intake was recorded for three consecutive days every month for all animals. Also blood haemoglobin estimation, R.B.C. and W.B.C. counts and blood serum analysis for protein, non-protein nitrogen, calcium and inorganic phosphorus were made quarterly. The data obtained is under analysis.

(iii) Faecal examination for worms by the concentration method was done every quarterly for dams and progeny. By regular treatment (mostly against coccidiosis and round worms) the number of intestinal parasites were kept under control, so that results may not be vitiated due to prevalence of these.

(iv) Reproductive data with regard to age at first oestrus, duration of the oestral period, service dates, calving dates and gestation period etc., were maintained.

(v) In respect of all the animals (except one sterile cow) first lactation records of daily milk yield and monthly butter fat were completed.

SCHEME TO STUDY THICKNESS OF SKIN AND DISTRIBUTION OF SWEAT GLANDS IN RELATION TO MILK YIELD

The scheme to study thickness of skin and distribution of sweat glands in relation to milk yield started functioning at the Indian Veterinary Research Institute, Izatnagar from October 9, 1957.

During the year under report a comprehensive review of world literature on this subject was prepared and considerable progress made in the development and standardization of the technique. For this purpose a number of samples of skin were obtained by using a special type of skin biopsy punch.

These discs were then processed in the laboratory in order to get thick vertical sections (which give undamaged sweat glands for measurement study) and thin horizontal sections (which enabled to count them). These procedures are found quite satisfactory and have given good results.

Further progress was somewhat hampered due to lack of certain items of essential equipment and adequate laboratory facilities. These deficiencies are being made up.

SCHEME FOR STERILIZATIONS OF SCRUB COWS, I.V.R.I., IZATNAGAR

The object of the scheme is to evolve a simple, cheap and bloodless method for induction of sterility in uneconomic cows and buffaloes with a view to stop their further breeding and thereby to reduce the number of such animals in India.

During the year under report investigations on the effect of intrauterine injection of a hard paraffin as a method of induction of sterility were conducted. In all 27 destrous cycles in six cows were studied. This treatment was, however, not found to influence the conception rate in cows and was considered unsuitable and impracticable for their sterilization.

Investigations on the effect of intrauterine injection of plaster of Paris solution and a cellulose plastic solution on reproduction in cows were also conducted. The treated cows are under observation.

Stainless steel tension clips were introduced in the cervix of six cows. These cows showed sign of heat after treatment. They were served and kept under observation.

A suitable design of an instrument for electrocauterisation of cervix was developed and some private firms were contacted for manufacturing it.

A short course of training in the present known techniques of sterilization of cows was conducted.

SCHEME TO STUDY PHYSIOLOGY OF THE HUMP, DEWLAP AND SHEATH OF CATTLE, CALCUTTA

The scheme started functioning from 1st September, 1957 with an object to study the physiology of hump, dewlap and sheath in order to have a better

understanding of the physiology of the farm animals with reference to their physiology of tolerance of climatic stress.

During the year under report histology and histochemistry of the different regions of the skin were studied and sweat glands were counted. The hides were obtained from slaughtered bullocks of local breed and skin pieces from seven regions of hide were selected. The regions were hump, dewlap, sheath, ventral skin (abdomen), dorsal skin (back), dorsal and ventral neck. The results obtained showed that concentration of sweat glands in the hump is higher in comparison to other regions of the skin. While the mean number of sweat glands in the hump was 4,066, the same was 1,503 in the back. The grand mean of the number of sweat glands for all the regions was found to be 2,685.

Histochemistry of alkaline and acid phosphates, PAS, fanlgen and glycogen were studied. It was found that the activity of alkaline phosphatase enzyme is present diffusely and in considerable amount in the glandular epithelium and the myoepithelium of the sweat gland as revealed by the deposit of black cobalt sulphate in these locations. Acid phosphatase activity could not, however, be demonstrated either in sweat or sebaceous glands.

PAS reaction was negative in the sweat glands indicating the absence of mucopolysaccharide in the sweat gland. The reaction was, however, slight in all the surrounding hair follicle and was strongly positive in the shafts themselves.

Glycogen could not be found either in the sweat or sebaceous glands.

CATTLE STERILITY

The work envisaged in the co-ordinated scheme on cattle sterility was in progress at the twelve regional sterility stations in different parts of the country. At the Indian Veterinary Research Institute, a new section of obstetrics and gynaecology in the Division of Animal Genetics was established on termination of the Scheme. New departments of obstetrics and gynaecology have been created in the following veterinary colleges on the eve of the work having been taken over by the Bombay, Bihar, West Bengal, Uttar Pradesh, Madras and Punjab States in 1958.

The progress of work at the other five stations, which are still under the aegis of the Indian Council of Agricultural Research, is summarized below:

Orissa. The scheme started functioning at Cuttack on the 1st August, 1958. An independent section of obstetrics and gynaecology has been created in the Orissa College of Veterinary Science and Animal Husbandry. The subject of obstetrics and gynaecology has been already introduced by the Utkal University in the curriculum of the B.V.Sc. and A.H. degree. During the period under report, 83 lectures were delivered to students of the final year B.V.Sc. and A.H. course in the subject of obstetrics, gynaecology and artificial insemination. Ninety-five hours were devoted to practical training. The ambulatory clinic was used with great advantage for imparting the practical training. In addition to the students in the veterinary college, 35 veterinarians and 66 stockmen from the State Veterinary Department were given practical training in artificial insemination. Six Key Village Officers from Rajasthan State also received training in artificial insemination and sterility.

For conducting studies on physiology and pathology of reproduction, two cattle herds and one buffalo herd have been selected. In all, 15 adult females (136 cattle and 50 buffaloes) were under observation during the period under report. A high incidence of metritis was found among cattle. The incidence of repeat breeding was also found to be high, though the animals were apparently normal. In addition, 54 Red Sindhi and 19 Hariana bulls belonging to different Artificial Insemination Centres, Key Village blocks and bull centres were examined for sex behaviour and sperm production of which 47 bulls were approved for artificial insemination work and 20 for natural service. The remaining six bulls were recommended for disposal.

Karale. Work under the scheme started in January, 1958. Regular teaching of the final year B.V.Sc. students was undertaken during the year under report. Clinical material from the college clinic, livestock farm, Ollukara, Veterinary Hospital and Key Village Centre, Ollukara was used for imparting practical training. Besides the B.V.Sc. students, 65 stockmen were given a two-week course of training in artificial insemination and sterility.

Studies on different aspects of physiology and pathology of reproduction were taken up on the animals of the livestock farm, Ollukara, and observations recorded in the prescribed standard forms. Cases of monorchidism and gonadal hypoplasia have been detected in bulls at the key farm centre and livestock farm, Ollukara.

Jabalpur. The work at this centre started in January, 1958. Two herds have been taken up for observation. The incidence of repeated breeding and cystic degeneration of ovaries appeared to be high among the cattle under observation. In addition, over 350 animals were clinically examined for pregnancy and various reproductive disorders. Steps have been taken to equip the department, and it is expected that all the necessary apparatus and instruments will be procured soon.

Andhra Pradesh. This scheme started on the 11th January, 1958. During the period under report, two herds have been selected for conducting studies on physiology and pathology of reproduction. These herds comprise 47 adult females of Deoni breed and 158 and 43 females of Murrah and Marathwada buffaloes. During 1958-59, 133 animals were examined at the college hospital, city hospital, and the agricultural college farm for pregnancy diagnosis and various reproductive disorders. Anoestrous ovaries were detected in 15 and adhesions in ovarian bursa in four cases. In all, 360 specimens of reproductive tract from Marathwada buffaloes were obtained from the local slaughter house for conducting studies on the biometry of genitalia.

Assam. Work under the scheme commenced on the 15th January, 1958. Steps have been taken to introduce the syllabus on obstetrics and gynaecology in the University curriculum. Short refresher courses were conducted to train officers of the development projects in artificial insemination and sterility work. During the period under report 39 officers were trained. Investigations in four herds in two Key Villages have been taken up for the execution of the technical programme. These herds comprise over 125 cross-bred cattle and 150 buffaloes. Vibriotic infection was suspected in one of the town dairy herds, but detailed investigation showed negative results.

SHEEP BREEDING

A co-ordinated scheme for research in sheep and wool has been sanctioned by the Indian Council of Agricultural Research. The object of research is to evolve breeds of sheep yielding superior fleeces. The sheep raising areas are divided into three main regions, viz., (i) Temperate Himalayan Region, (ii) Dry Northern Region and (iii) Southern Region. Main research stations, with sub-stations in the joining States or sheep breeding areas have been established with the co-operation of respective States.

Temperate Himalayan Region. This region comprises the hill districts of Uttar Pradesh, Himachal Pradesh, Kashmir and the Punjab.

The principal station is located at Pipalkoti in Uttar Pradesh, with additional stations at Bannihal in Kashmir and at Sarhan in Himachal Pradesh. The basic approach in conducting experimental breeding at these stations is to cross-breed ewes of the local types to the fine woolled imported rams. The work carried out at the various stations in this region is summarised below:

Uttar Pradesh (Pipalkoti). During the year under report, the flock was re-organized and the ewes were allotted to four Rambouillet rams, avoiding in breeding or close alliance. Each ram received identical number of F_1 , Rambouillet and Rampur Bushier ewes. Out of 92 ewes mated during the year, 79 conceived and 76 lambs were born. There was no twinning in the flocks. Apart from the breeding operation carried out at the farm, 1,154 ewes belonging to private flock owners were mated to the Rambouillet rams and cross-bred rams.

The mortality among the adult flock was 9.8 per cent; while due to inclement weather the mortality among the lambs was 48 per cent. The average body weight of lambs ranged from 6.4 lb. to 7.1 lb. for the Rambouillet male and female lambs respectively. The birth weight of the F_1 cross-bred lambs was 5 lb. for the male and 4.4 lb. for the female progeny. The birth weight of F_2 cross-bred progeny was slightly higher, i.e., 5.8 lb. for the male and 4.9 lb. for the female progeny.

Average wool yield obtained from the pure-bred Rambouillet ewes was 72.32 oz.; the yield from Rambouillet F_1 cross-bred was 50.04 oz., for Rambouillet F_2 crosses 52.0 oz. and for Rampur Bushier ewes 33.12 oz. In all 3,717 wool samples were analysed. A study of the March-September clip indicated that the winter group was finer. It was further observed that the wool of the cross-bred sheep increased considerably in density. The fibre density in fleeces of Rampur Bushier was 1,252 per sq. cm. while in the F_1 progeny it was 2,608 per sq. cm. and 4,397 per sq. cm. in the fleeces of F_2 progeny. These figures compared favourably with the content of 5,468 fibres per sq. cm. of the fleeces of pure-bred Rambouillet stock. However, there was a reduction in the fibre length from 65.64 mm. in the Rampur Bushier to 57.98 in the Rambouillet cross-bred progeny. The clean wool yield was 69.18 and 66.51 in the case of F_1 and F_2 progeny, as against 73.09 of the Rampur Bushier fleeces.

Out of the 963 samples received from different sheep farms and stud-rams centres in the State, 14.75 per cent of the samples had a medullation ranging from 0 to 20 per cent; 26.37 per cent of the sample in group ranging from 40 to 70 per cent; and the rest of the samples had medullation over 70 per cent.

Jammu and Kashmir (Bannihal). The experimental breeding of sheep in this State is carried out at two places, the main farm being located at Bannihal for summer grazing and a sub-station at Riassi for the winter months. The breeding of pure-bred Rambouillet, cross-breeding of the local sheep to the Rambouillet rams and continuation of inter-breeding among the selected flocks born of the cross-bred Merino sheep, are the three main items of work at this station.

During the year under report, the highest body weight, so far recorded at this institution was 212 and 159 lb. for the farm-bred Rambouillet ram and ewe respectively; wool yield was 11 lb. for the Rambouillet ram and 9 lb. for the ewe respectively.

The physical analysis of wool sample of pure-bred stock indicated the lowest mean diameter as 17 microns for sample from ewe No.X12 and ram No.X41 and X42. The highest density was 33,000 for the ram No.X41, X42 and X16. The lowest scouring loss was 23 per cent.

During the year, 144 F_1 and F_2 ewes were mated and 123 lambs were born; lambing percentage was in the neighbourhood of 85 per cent. Largest number of lambs were born in the birth weight group ranging from 5 to 6 lb. and from six ewes which were sired by ram Nos. X15 and X38. Sire Nos. X39 and X38 produced ram lambs weighing from 7 to 8 lb. Based on the data collected for the last six years, it was observed that the adult weight was generally related to the birth weight.

All the sheep were shorn twice a year in the months of March-September. The average greasy wool yield recorded for F_1 and F_2 Rambouillet progeny was 57 oz. and 51 oz. respectively. A study of fleece quality of 18 local ewes, 71 F_1 daughters and five F_2 daughters, indicated that the average fibre length had decreased from 8.7 cm. to 6.4 cm. from foundation stock to F_2 progeny, while the medullation had been totally eliminated in the F_1 generation. Scouring loss had increased from 11.3 to 17 per cent. The diameter of fibres had decreased from 33.3 to 24.2 microns. The density of fibre had increased from 5.9 to 17.8 fibres per sq. cm. The mortality among the flock was 11.7 per cent, as against 14 per cent recorded in the previous year. The introduction of cross-bred rams among the village flocks was carried out by locating 99 cross-bred rams.

Himachal Pradesh (Sarhan). The expansion of the sheep breeding farm at Sarhan continued during the year and an additional area of 164 bighas of land was acquired. The construction of quarters for the staff and sheds for the flocks was also undertaken. This farm is now in a position to raise 600 to 800 sheep. Of the 226 ewes mated 195 conceived; of these ewes 87.6 per cent lambed. It was observed that October-November were the best months of the year for mating to obtain highest fertility. The average birth weight was 4.9 lb. for ram lambs and 4.8 lb. for the ewe lambs. Weight of the Rambouillet cross-bred lambs was 4.13 lb. for both the sexes. The average wool yield was 122 oz. for the pure-bred Rambouillet rams as compared to 61 oz. obtained from the Rampur Bushier rams.

Dry Northern Region. This region comprise the States of Rajasthan, Gujerat and parts of Uttar Pradesh and the Punjab.

Bikaner (Jorbir). The work at this centre is primarily to carry out selective breeding of the Chokla sheep with a view to improve the quality of fleeces.

The work of construction of buildings and paddocks was in progress during the year. A foundation flock was purchased and 20 per cent of the flock obtained was selected at random to form a control group. Based on 128 ewes mated, tupping and lambing percentage worked out to 68.72 and 63.28 per cent respectively. The average birth weight of lambs recorded was 6.6 lb. and 6.2 lb. for male and female respectively; the maximum for each sex being 8.4 and 8.0 lb.

Shearing was done twice in the year. The average wool weight recorded was 76.8 oz. for the rams and 55.73 oz. for the ewes. In order to undertake investigations among the village flocks, preliminary steps have been taken and staff has been appointed. A study of the wool quality of the foundation flock indicated that (based on midside samples) the diameter of the fibres increased with the age of the sheep. However, there was an increase in the different types of medullated fibres, corresponding to the decrease in the wool fibre percentage. The difference in staple length of an age group was negligent. A study of seasonal variation of the wool quality indicated that the autumn wool was slightly coarser and was more medullated in the autumn than in the summer.

North Gujarat-Patan (Joria). The work at this station is restricted to selective breeding among kutchi-patanwadi and Marwadi types.

Kutchi Sheep. During the year five rams were selected to head the flock consisting of 107 ewes. The tupping and lambing percentage was 89.7 and 86.5 respectively. Eighty-three lambs, 37 male and 46 female were born. The average birth weight of the male and female progeny was 6.4 and 5.9 lb. respectively. The average wool yield was 20.9 oz. from the ewes and 22.3 oz. from the rams.

The sire evaluation was carried out and the sires were ranked on the basis of their performances. It was found that the sire No. M 440 had performed the best in respect of all characteristics; while other sires performed better in one or the other respects.

The per cent gain for each generation was carried out to study progress made during selective breeding. It was observed that the foundation flock yielded on an average 29.2 oz. of wool, while the first and the second generation normally yielded 30.0 oz. and 29.8 oz. respectively. These records indicated that there was no significant change in the wool yield from generation to generation. The two attributes of wool quality, namely the percentage of medullated fibres and the diameter of fibres indicated significant increase from the foundation flock in the first generation and a significant decrease in the second generation, the fleece density showed an increase in the first generation and the same level was maintained in the second generation as well.

Kutchi, Marwadi Sheep. A small flock of 37 ewes was maintained at the farm and two rams were selected for breeding. During the year, 29 lambs—17 male and 12 female were born. The lambing and tupping percentage was 86.48 and 90.63 respectively. The fleeces of the progeny had 53 per cent medullated fibres as compared to 51 per cent in the fleeces of the dams. The average fibre diameter of the fleeces of both the mother and their progeny was of the same order, being 36.50 and 32.65 microns respectively. Fleece density was 850 fibres per sq. cm. in dams and 844 per sq. cm. in the progeny. The average wool yield was 30.2 oz. in ewes and 38.5 oz. in rams.

Poona Farm. *Selective Breeding—Deccani Sheep.* During the year, 46 ewes were mated to two rams. The tupping and lambing percentage was 88.46 and 78.26 respectively; of the lamb crop 19.4 per cent had colour in their fleeces. The average birth weight was 6.23 lb. of the male and 6.18 lb. of female lambs. The average weekly gain in body weight worked out to 1.45 lb. There was no sire influence as regards birth weights or the rate of growth. A study of fleece quality of the dam and progeny comparison indicated that the medullated fibres decreased from 20 per cent in the fleeces of dams to 13 per cent in the progeny. One of the rams No. X501 proved to be superior in reducing the percentage of medullation. The fibre diameter of the fleeces of dams was 37.09 microns, as against 26.30 for the progeny. The fleece density in respect of two generations did not change significantly. The average wool yield of the fleece was 20 oz. for the year.

Cross-breeding (Forward Mating towards the Merino). During the year, 57 ewes were mated in 278 Merino rams and 56 lambs were born. The average birth weight of male lambs was 6.7 lb. and of female lambs 6.4 lb. The average week's gain in body weights of lambs, from birth to 18 weeks was 1.51 lb. in male lambs and 1.28 lb. in the female lambs. The results of analysis of the wool samples indicated that all the attributes of wool quality had considerably improved. The percentage of medullated fibres was reduced from 41 per cent in the fleeces of dams to 22 per cent in the progeny. The fibre diameter was reduced from 44 microns of the fleece of dams to 25 microns of the fleeces of the progeny. The fleece density of 725 fibres per sq. cm. in dams increased to 1,014 fibre per sq. cm. in the progeny. The average wool yield (the first clip) of the progeny was 18 oz.

Forward Mating towards Rambouillet. In this line of work, 135 ewes were mated to five Rambouillet rams and 99 lambs were born during the year. The average birth weights of the male lambs was 6.3 lb. and that of the female lambs was 6.2 lb. The average weekly gain in body weights from birth to 18 weeks of the male lambs was 1.35 lb. and that of the female lambs was 1.37 lb. The sires were found to be influencing the growth rates of the lambs. The results on analysis of wool indicated a reduction in medullated fibres from 33 to 7 per cent; reduction in fibre diameter from 40 microns to 22 microns; increase in fleece density from 723 fibres per sq. cm. to 1,414 fibres. Breeding rams were distributed in the rural areas, Community Development Blocks and National Extension Service Blocks. The data was collected from 22 controlled flocks. It was observed while comparing the performance of the dams and progeny, that the fibre diameter reduced from 35 to 32 microns. The average percentage of medullated fibres was 19 to 16 per cent. The fleece density increased from 795 fibres per sq. cm. to 1,109 fibres per sq. cm. During the year under report, total number of 8,515 samples of wool were analysed at the wool analysis laboratory.

Nilgiris Farm (Madras). The object of research at this station is to improve the quality and increase the quantity of wool produced by the Nilgiri sheep, both by selective breeding and by cross-breeding with the Romney-marsh rams. Under the programme of selective breeding, 43 ewes were mated in the first mating season. Out of these 16 lambs were born; the percentage of lambing was 37.2. In the second season, however, percentage was 75, and 25 lambs were born. In the case of 152 ewes mated under the cross-breeding programme, the percentage

lambling was 12.4 and 48.4 for the two seasons. The average wool yield from nine pure-bred Romney rams was 10.5 lb. for the year. The average wool yield for Nilgiri sheep worked out to 1.7 lb. as against 1.4 lb. in the previous year. In the case of cross-bred rams and ewes the yield was recorded as 3.15 lb. to 2.5 lb. respectively. The average for the entire cross-bred flock being 3.4 lb. The quality of wool in respect of selective-bred progeny and cross-bred progeny was being studied. Nearly 50 per cent of the Nilgiri sheep yielded wool with a medullation percentage from 0 to 5 per cent; 17 per cent were in the range of five per cent to ten per cent; the rest 11 per cent were in the range of 10 to 15 per cent.

Sheep Research Station, Hissar (Punjab). Research under this project started in the year 1953, for conducting experimental breeding programme to improve wool of a flock of Bikaner sheep, under range conditions. Studies in the heritability of wool characteristics and methods for studying fleeces were also to be carried out.

The flock was divided into two groups. Both the flocks were further divided into 12 groups. Each group was headed by a ram. The fertility in the flock was 54.3 per cent in flock A and 65.3 per cent in flock B. Under the programme of work for standardization of methods of measurements of different characteristics of sheep and wool, it was observed that the assessment of clean fleece yield for conducting heritability trials could be made on the basis of obtaining samples from the shoulder region. The assessment of fleece covering by score system was a reliable method and the character persisted in subsequent assessment. The assessment of fleece density could be made with two samples from the back region with an error of five per cent. To assess the medullation in the fleeces, a system by which samples were constituted by taking pinches of staples from different regions in proportion to the area of each region, was a reliable technique. The same technique could also be applied for the study on fibre thickness and its variability. The work on heritability studies was continued. During the year the flocks suffered losses from Strongyle worm infestation.

Physiological Studies of Sheep Skin to evaluate the Wool Quality. This scheme started functioning in May, 1958 at the Sheep Research Station, Poona. The object of the scheme is to study the growth and development in follicles of skin of sheep and goats in relation to the quality of wool or mohair; the structure and development of skin follicle had different stages of growth and variability. Studies in the density of follicles in relation to secondary and primary follicles, the proportion of medullated and pigmented follicles was carried out. The correlations among these attributes and that of the wool quality such as the fibre diameter, fleece density, etc., are also proposed to be studied. During the year under report, the work was undertaken on the standardization of techniques for obtaining cross-sections of the skin and methods of straining etc. A total of 69 samples were collected from the Deccani, Merino, South-down, Bannur crosses and other cross-bred animals. It was observed that the follicle density in the case of the Deccani was the lowest. It was highest in the 3/4 Merino sheep. In the case of goats the follicle density increased with the percentage of Angora blood. Useful basic information is being obtained under this scheme and further work is in progress.

Defining Breed Characteristics of Sheep with Joria Region of Northern Gujarat. The scheme started functioning in November, 1958 and after a preliminary survey, suitable places for the collection of flocks were decided upon. The flock-owners were contacted and with their co-operation 3,000 wool samples were collected. A committee was formed for defining breed characteristics and a programme for holding the meetings of the committee was drawn up.

Breeding Sheep for Meat Production. A co-ordinated scheme for the development of mutton breeds of sheep was sanctioned. Reports in respect of two stations from Chintapalli (Andhra Pradesh) and Poona (Bombay) were received. These projects have been launched with the object of studying the potentiality of the Mandaya and Nellore breeds of sheep for producing mutton and to explore the possibilities of evolving new superior strains by cross-breeding.

The Scheme in Andhra Pradesh was undertaken during the later part of the year and preliminary steps with regard to appointment of staff, construction of sheds etc., were taken.

The work in Bombay on selective breeding of the Bannur sheep and crossing these to the Somali rams was undertaken. During the year, 86 ewes were mated to four rams and 53 lambs were born. The average weights of lambs recorded was 4.5 lb. The average growth rate was 0.70 lb. per week. Of the total ram lambs born, 57 were slaughtered at the age of 7, 13 and 20 months. It was observed that the dressing percentage which was 40.3 at six months age increased to 57.9 per cent at 20 months age. The Bannur $\times$ Somali, cross-bred lambs born in 1957 were also slaughtered. In the group of rams, the dressed weight at seven months averaged at 59.2 lb.; the range being 56.9 to 60.0 lb. The scheme envisaged a programme of cross-breeding Bannur ewes with the Dumba rams. The work could not be taken up as the rams were not imported.

POULTRY BREEDING

Cross-breeding of Poultry Scheme, Allahabad. The scheme has been running at the Agricultural Institute, Allahabad since May, 1956. The object of the scheme is to compare efficiency of straight forward cross-breeding as against recurrent reciprocal crossing in poultry, with a view to collecting basic information for determining a policy of breeding for commercial egg production. During the year under report, in all 4,700 eggs were set. Over-all hatchability was 40 per cent. A breed-wise study of hatchability in eggs from 117 sires used on the flock revealed that infertility was highest in R.I.R.'s. This was due to late sexual maturity of cockerels in R.I.R. breeds. White Leghorn birds started to lay at about 6½ months of age and the two cross-bred breeds started between 6½ to 7 months. The R.I.R.'s. started laying at about eight months of age. Based on the egg production of those hens which survived 365 days, the egg production was 86 for R.I.R., 99 for WL, 95 for WL-RIR and 111 for RIR-WL. The causes for the decline of egg production as against parental stock which was 140 were being examined. Estimates of heritability obtained by inter-sire correlation among half-sibs were 20.6 per cent and 9.4 per cent for the age at first egg and 365 days egg production respectively. The average egg weight for R.I.R. and WL breeds was 2.0 ounces and 1.9 ounces respectively. The average weight of eggs from cross-breeds was the same as that of the group

from which the sires came. The estimate of heritability for the presence of average egg weight was negative. Further studies on different sets of crosses are being continued.

Poultry Development Scheme, Kerala. This scheme started in April, 1956. The object of the scheme was to study suitability of two exotic breeds of fowls; White Leghorn and Rhode Island Reds in heavy rainfall and humid climate and to upgrade *desi* stock. It was observed that the fertility of eggs set for incubation was not affected by withholding greens or shark-liver oil or both from the ration. The average weight of White Leghorn pullets which matured in 147 days was three pounds and eleven ounces in the case of first hatch. In the case of subsequent hatches which matured in 148 days, the average two ounces. The average weight of Rhode Island Reds was four pounds and weight was three pounds and seven ounces in the case of first hatch and four pounds and one ounce in the case of second hatch. The scheme has now terminated and the final report is awaited.

Investigations on the Possibilities of Correlations between Physiological Body Characteristics and Egg Production, I.V.R.I. The scheme started functioning at I.V.R.I., Izatnagar in December, 1959. The object of the Scheme is to study relationship between different body characteristics and physiological characteristics like early sexual maturity, lack of broodiness, lack of winterpause and intensity and persistency of production. During the three-month period covered by the report, a Committee of three persons was working on the first batch of R.I.R. and White Leghorn pullets in recording the initial score of the individual bird. Details of the experiments are awaited.

Defertilization of Eggs—Follow up Work—I.V.R.I. The scheme started at the I.V.R.I. during June, 1958, with a view to study the effect of temperature and humidity during different seasons on internal condition of thermo-stabilized and untreated eggs when transported from Haringhata (West Bengal), Trichur (Kerala) to Izatnagar (U.P.). The thermo-stabilization was carried by dipping the hen eggs at 130°F for 15 minutes and duck eggs at 126°F for ten minutes. Studies are also being continued on wrapping material and packing containers.

It was observed that thermo-stabilized eggs were superior to the untreated eggs. Percentage of putrified inedible egg showing no embryo formation and that of stale eggs (edible) was higher in untreated hen eggs and duck eggs as compared to defertilized eggs. Rate of deterioration of treated as well as untreated duck eggs was found to be lesser than that of the treated as well as untreated hen eggs. It was further observed that the eggs wrapped immediately after defertilization while the shell was moist were inferior to the eggs wrapped when the shell was well dried. There was no significant difference in loss in weight and air cell size in transit for treated and untreated eggs. The scheme has been extended upto March, 1960, with a view to obtain the data pertaining to all the seasons. The final report of the work is awaited.

Commerical Chick Hatchery and Poultry Processing Plant Pilot Project, Katpadi. The scheme started in June, 1955, with the object of investigating the possibilities of establishing a commercial hatchery and a processing plant under local conditions. During the year under report out of 21,506 chicks hatched 4,827 were lost or were destroyed during rearing. In all 16,679 chicks were supplied

to Village Model Poultry farms, individual breeders, N.E.S. Blocks and other Poultry Development Schemes. Twenty-one village farms were functioning during the year.

In view of breakdown of freezer and lack of facilities for delivery of meat in frozen condition, the work on this aspect could not progress to the expected degree. However, 130 birds slaughtered were sold to public, 97 of which were sold as frozen meat. The dressed weight (as compared to live weight) excluding head, legs and intestines but including gizzard, heart and liver was 67.59 per cent. The staff of the Scheme helped the breeders in culling unproductive birds; 325 such birds were culled during the year. The 21 Poultry Units established accounted for a production of 69,593 eggs. The average egg production per hen at these units worked out to 121.22 per annum.

Distribution of White Leghorn Chickens to Villagers—YMCA Marthandam, Madras. The scheme started in August, 1957, with the object of saturating Marthandam and its surrounding villages with high yielding White Leghorn birds and to establish a commercial hatchery. The scheme had made considerable progress during the year under report. As against 4,751 eggs set for incubation in the previous year, during 1958-59, 15,700 eggs were set. The over-all hatching percentage was reported to be 50 per cent. The percentage of hatchability for fertile eggs was about 56.9 per cent. In all, 3,655 chicks were supplied to the various units. The work is expected to progress further since transport has been made available to the scheme.

Cheap Poultry Houses. The Council has sanctioned a scheme to study the utility and effect of different types of cheap poultry houses made by local artisans utilising the local raw material on the growth, health and productivity of birds. The results of scheme will help to popularize poultry keeping by reducing the cost of housing. Schemes have been functioning in the States of Uttar Pradesh, Orissa, Madras, Andhra and Madhya Pradesh. The work is in preliminary stages and results will be reported next year.

Systematic Supply of Poultry Ration. The Council has sanctioned schemes in Delhi and Punjab for supply of poultry feed mixtures to the poultry breeders with a view to popularise such feed mixture and to improve the standards of feeding. The scheme at Delhi has terminated and work in Punjab is under progress. The reports of the scheme are awaited.

Duck Breeding, Kerala. The scheme was started in November, 1957, with the object of studying the economic qualities of Indian Runner and Khaki Campbell Ducks under ideal conditions of housing, feeding and management. It was also envisaged to establish suitable strains by upgrading the local stock and to conduct studies on the problems of duck husbandry. In view of mortality in the imported stock, the work is now confined to the selective breeding aspect of locally purchased ducks. The work is in progress but has been considerably affected by high salinity of the back sea water utilized in the canal. Efforts are being made to improve matters. Growing ducks were found to ingest more ration than the adult ducks.

Duck Breeding Scheme, I.V.R.I. The scheme commenced in December, 1955, with a view to explore the possibilities of rearing and breeding of pure-bred Khaki Campbell Ducks without water tanks, etc. Work is being continued with the hatches

obtained from Khaki Campbell eggs procured from the Government Poultry Farm, Midnapur, West Bengal.

A study of cold and warm breeding revealed that the cold breeding could be practised during March and April in temperate regions with considerable saving in cost. There was no difference in the weight of ducklings reared in warm and cold brooder. The average weights in warm and cold brooding at eight weeks were 53·7 oz. and 50·2 oz. respectively. The 125 ducklings hatched from January to March showed excellent health and the mortality was insignificant. The average age of sexual maturity for these hatches worked out to 154·3 days. Drinking water was changed four to six times a day depending upon the weather conditions and the number of birds kept. No difficulty was observed in rearing the birds under restricted supply of water.

ANIMAL DISEASES

A number of schemes for investigation and control of diseases of cattle, buffaloes, sheep, goats, pigs and poultry, as well as, schemes for certain specific disease problems continued to function in almost all the States and at the Indian Veterinary Research Institute, Mukteswar and Izatnagar. As usual, the progress reports and technical programmes of all these schemes were scrutinized and co-ordinated by the Council.

Bovine Mastitis. The co-ordinated scheme for investigation of bovine mastitis continued to function at the I.V.R.I. and in the States of Uttar Pradesh and Madras. The scheme had already terminated in the Punjab, Mysore and Bombay.

The progress at various centres is given below:

Uttar Pradesh. Systematic investigation of the disease was carried out in the dairy herds located at Babugarh, Hastinapur and Manjhara, and at the Agriculture College, Kanpur. A total of 380 animals was examined. Of these, 119 cows and 198 buffaloes were in milk, and 38 cows and 25 buffaloes were dry. The incidence of mastitis was 13·9 per cent among cows and 11·7 per cent among buffaloes at Babugarh, 8·4 per cent among buffaloes at Hastinapur, 38·9 per cent among the Sahiwal cows at Kanpur, and 30·2 per cent among the buffaloes at Manjhara. The cows showed a direct correlation of advanced age with the rate of infection, but the pattern of distribution in the different age groups of buffaloes was not found similar to that in cows. Analysis of the results of indirect tests showed that the results of leucocytic count were closely correlated with the results of cultural examination. The accuracy of the whiteside test was 60·9 per cent and that of both the chloride test and the bromo-cresol purple test was 69·0 per cent. Treatment with a combination of penicillin, streptomycin and sulphamezathine was found effective in 95·3 per cent of the quarters treated, provided the treatment was started in the early stages of the disease.

Bombay. The scheme in Bombay continued to function till the 31st March, 1959, after which it was taken over entirely by the State Government. During 1958-59, 179 animals were examined, comprising 45 cows and 134 buffaloes. From these, 427 individual quarter samples and 69 pooled samples were collected and

examined. Twenty blind teats were recorded. Out of 45 cows examined, six showed latent infection in nine quarters, three showed early clinical infection in three quarters, five showed advanced clinical infection in eleven quarters, and the remaining 31 cows were free from infection. Out of 65 buffalo milk samples collected from individual quarters, 13 showed a latent infection, four showed early clinical infection, one showed advanced clinical infection, and the remaining did not reveal any infection. Out of the 69 pooled buffalo samples, eight indicated presence of latent infection, and the remaining 61 were free from infection. Fifty-three organisms were isolated from the infected milk samples, and these were indentified to be *Streptococcus agalactiae* 19, *Str. dysgalactiae* 12, *Str. uberis* 6, and *Staphylococcus aureus* 16. The incidence of blind teats in cows and buffaloes was 22.22 per cent and 7.4 per cent respectively. During the year under report, a total of 20 latent cases and 15 clinical cases were treated with different combinations of antibiotics and sulpha drugs. Out of these, 20 latent cases and 8 clinical cases were cured.

Madras. Survey was conducted in three government farms, viz. Livestock Research Station, Hosur, District Livestock Farm, Pudukottai, and District Livestock Farm, Orathanad, and at the Madras Veterinary College. Out of the 112 animals examined, 26 (23.21 per cent) were found to harbour infection. The leucocytic count and microscopic examination of incubated milk showed good correlation. From 33 quarter samples streptococci were isolated on cultural examination, including *Str. agalactiae* 2, *Str. uberis* 7, *Str. equisimilis* 1, and *Str. group F*. Staphylococci were isolated from 122 quarter samples, and of these only nine were *Staph. aureus*. The incidence of mastitis was found to be 79.5 per cent in old cows of above five years of age. Treatment was conducted in nine cases with a combination of penicillin, streptomycin, sulphamezathine, and cobalt sulphate. It was successful in the case of *Str. uberis* and *Staph. aureus* infections.

I.V.R.I., Izatnagar. A survey was carried out at the Military farms, Jabalpur and Secunderabad, to ascertain the extent of prevalence of mastitis and to find out the various organisms responsible for infection. In all 451 milk samples from 113 cows and 412 samples from 104 buffaloes at the Jabalpur farm and 205 milk samples from 52 cows and 659 milk samples from 171 buffaloes at the Secunderabad farm were subjected to cultural examination. The incidence of mastitis at Jabalpur and Secunderabad was 34.5 per cent and 26.9 per cent in cows and 14.4 per cent and 26.9 per cent in buffaloes, respectively. Almost all the types of mastitis organisms were encountered on bacteriological examination. Of the therapeutic agents employed, singly or in combination, the combination of penicillin, streptomycin and cobalt sulphate was the best for all types of mastitis. As a result of partial adoption of control measures recommended for the farms at Kirkee and Pimpri, which previously was 48.5 per cent at Kirkee and 60.0 per cent at Pimpri, came down to 24.0 per cent and 33.3 per cent respectively.

Brucellosis. Schemes for the investigation of brucellosis were in operation in the States of Uttar Pradesh and Madras. A similar scheme has been sanctioned for Bihar with effect from 1-4-1958.

Uttar Pradesh. The scheme in Uttar Pradesh has been working since January 4, 1956. Sixteen State farms were tested during the last three years. The positive reactors which were unproductive were transferred to Gosadan and

the productive ones were shifted to two isolation farms. Brucella-free herds were declared closed herds and periodical testing was carried out. As many as eight farms are now free of brucellosis. In some farms, however, owing to imperfect control measures, the disease was on the increase. In the three re-tests carried out on the 16 farms 3,959 animals were tested, out of which only 43 gave positive reaction. The over-all incidence declined from 2·5 per cent to 1·1 per cent.

A survey to assess the incidence of brucellosis in village cattle was conducted and 350 samples were tested from rural areas around Mathura, but none was found to be positive. Of the 243 breeding bulls tested, only one was found positive and was castrated. All the 1,334 animals so far tested were found to be negative. Two successive agglutination tests with *Br. abortus* and *Br. melitensis* antigens did not reveal any positive reactor among sheep and goats maintained on a number of these farms.

Some significant changes were observed in the blood picture of adult heifers following vaccination with strain 19 vaccine. Agglutinins appeared in the blood on the fourth day after vaccination, maximum titre being reached on the 18th day. The titre began to decline on the 23rd day and came down to 1:10 on 183rd day after vaccination. Erythrocyte sedimentation rate was 1·0 mm. to 3·0 mm. per hour on 18th day after vaccination; leucocytic count increased from 9·250 to 12,331 per cmm. The specific gravity decreased inversely with the rise of agglutinin titre. Samples of semen, vaginal discharge, and discharge from metritis in animals on farms and elsewhere were all negative for any type of genital infection. In the course of re-testing it was found that some positive reactors had become negative and some high-titre reactors were showing low titre values.

Madras. The scheme in Madras started at Ranipet on the 6th June, 1957. During the year, 256 villages and 31 towns in five districts were surveyed. Blood serum from 10,193 animals of different categories was tested. Of these, 243 animals from 75 villages proved positive to the quick agglutination test and the rest were negative. In addition, 202 samples of blood serum and synovial fluid were tested, of which 123 were found positive to the agglutination test. Twenty-six samples of milk, vaginal swabs and foetal stomach contents were examined culturally, biologically and serologically, and nine strains of *Brucella* were isolated from these.

Contagious Bovine Pleuro-pneumonia. A scheme for the control of contagious bovine pleuro-pneumonia is working in Assam State with headquarters at Gauhati since 1951. The disease was confined to four districts comprising a total area of 150 sq. miles and about 200 villages with a cattle population of approximately 1,20,000. As a result of the vaccination and control measures persistently adopted, Goalpara district, which was once the main seat of infection, is now almost free of the disease.

Besides mass vaccination with live virus vaccine, treatment of the infected animals with sulphamezathine-sodium solution and tablets gave encouraging results. The whole blood agglutination test was of great advantage in detecting almost accurately the non-clinical as well as clinical cases under field conditions. Vaccination showed positive reactions in 50 per cent animals within seven days, in 75 to 85 per cent within 10 to 12 days, and in almost 100 per cent within 14 days, irrespective of age, sex and body weight. The vaccine used was a strain of the organism

maintained by continuous passage in local bull calves and attenuated by serial cultivation on artificial media. The organism was also said to have been successfully cultivated in the growing chick-embryo. The viability, potency and immunogenicity could be increased by preparation of the freeze-dried, egg-adapted, and adjuvant vaccines.

Retention of Placenta. The scheme for investigation of the incidence of retained placenta and determination of the bacteriological flora of the tubular genitalia in bovines was started on December, 12, 1955 in the State of Orissa. During 1958-59, the incidence of retention of placenta was studied in various Government cattle farms. The percentage of incidence of abortion in cows was found to vary between 2.08 per cent in District Livestock Breeding Farm, Bolangir to 30.26 per cent in District Livestock Breeding Farm, Bhanjanagar. In the case of buffaloes the incidence of abortion was four per cent at the State Livestock Breeding Farm and ten per cent at the District Livestock Breeding Farm, Bolangir. The incidence of retained placenta following normal calvings among cows was found to be 7.07, 5.0, 0.0, 3.2, and 6.25 per cent at the State Livestock Breeding Farm; District Livestock Breeding Farms, Bhanjanagar, Boudh, and Bolangir; and in Victoria Goshala, Cuttack, respectively. The figure for buffaloes at the State Livestock Breeding Farm was 8.33 per cent. Uterine discharges and other material from 55 animals representing normal calvings, retained placenta, metritis, etc. was examined bacteriologically and pathogenic organisms were demonstrated in 28; and these included *Br. abortus*, *C. pyogenes*, *E. coli* and streptococci.

Hump Sore. A co-ordinated scheme for the control and eradication of Stephanofilariasis in cattle has been sanctioned in the States of Orissa, West Bengal, and Assam.

The object of this scheme is to investigate the life-cycle of the *Stephanofilaria* and to develop suitable measures for the control and treatment of the disease. Details of work in various states is given blow.

Orissa. During 1958-59, 87 male and 136 female specimens of *S. assamensis* were collected from affected cattle. Out of these, 50 males and 50 females were injected into the hump of disease-free animals which were kept in mosquito-proof sheds. The infection could not be transmitted in this manner.

Dissected and examined for microfilaria were 152 mosquitoes, 83 flies, 42 ticks, and 14 lice collected from the bodies of affected animals and their neighbourhood. In six culicine mosquitoes unsheathed microfilariae were detected in the gut, but they could not be indentified. For histopathological studies to determine the density of the parasites in various parts of the humpsore lesion, 206 transverse sections were prepared and were under examination. In all, 291 cases of clinical humpsore were treated by various methods. Hetrazan ointment and Novolep proved more efficacious than sodium antimony tartrate.

West Bengal. During the year under report, blood smears from ear veins of 137 animals affected with humpsore and 571 apparently unaffected animals were examined. Seathed microfilariae resembling *Setaria* species were detected in four affected and six apparently unaffected animals. These microfilariae had no resemblance with those of *S. assamensis* obtained from the humpsore lesions. Specimens of healthy skin from 103 humpsore affected and 112 apparently

unaffected animals were examined, and long, unsheathed variety of microfilariae were detected in 88 and 67 animals respectively.

Over 4,000 winged arthropods collected from sheds and from the bodies of the affected animals were dissected. Living larvae were encountered in the proboscis and head of 14 muscid flies. Six crows were caught while pecking on hump-sore lesions. Microscopical examination of their heart blood revealed microfilariae resembling microfilariae of *S. assamensis* in two of them.

Treatment with various drugs, including acetylsan, phenergan, and ointment containing phenothiazine, D.D.T., and phenol, was tried on 137 animals with inconclusive results.

Assam. During 1958-59, under Nasal Schistosomiasis scheme, 785 animals affected with nasal granuloma were treated, of which 388 were completely cured. Faecal samples of 85 bovines and five sheep were examined, of which 65 bovines and 3 sheep were found positive for liver fluke and were treated with hexachloroethane.

Toxic reactions caused by injection of antimony compounds were combated with some success by anti-histamine drugs.

Fascioliasis. A number of schemes for the control of parasitic diseases, especially liverfluke infestation, have been sanctioned by the Indian Council of Agricultural Research.

Under these schemes, the infestations are controlled by regular administration of antiparasitic drugs. A brief account of these schemes is given below.

Mysore. A scheme for the control of liverflukes in Mysore was started on the 1st June, 1953. It was terminated on 31st March, 1960.

In all, 1,30,441 animals in several villages of the fluke-infested areas were put under regular treatment with anti-liverfluke drugs during 1958-59. Faeces of 601 animals kept under special observation were examined regularly to evaluate the efficacy of the treatment. Of the 441 animals from which faecal samples were received regularly, 439 remained negative throughout the year in spite of constant exposure to infestation.

Bihar. During 1958-59, the pre-treatment incidence of infection was determined by faecal examination and fluke egg counts in all the villages under observation. Seven to eight rounds of dosing with carbon tetrachloride were given in two monthly group of villages, four rounds in four monthly group of villages, and three rounds in six monthly group of villages. Comparison of statistically analysed data indicated that two monthly and four monthly methods of treatment were significantly efficacious in reducing the incidence of infection, but to avoid the unnecessary hazards of too frequent dosing the latter was found to be more convenient. Besides the experimental work carried out under observation, mass treatment in adjoining villages was undertaken with appreciable results.

GENERAL DISEASE INVESTIGATION

Schemes of general disease investigation are sponsored by the Indian Council of Agricultural Research with a view to investigating the aetiology, mode of spread, and control of infectious, non-infectious, and obscure diseases. In most of the States where such schemes have been in operation for a number of years the work

has been taken up on permanent basis by the State Governments. During the year under report, investigation schemes were in operation in the following States:

(PEPSU) Punjab. Diseases like haemorrhagic septicaemia, rinderpest, foot-and-mouth disease, and black-quarter were commonly met within Punjab. Among the outbreaks of these diseases more than 50 per cent were those of haemorrhagic septicaemia. At the Bhupendra Dairy Farm, Patiala, 142 animals and 85 animals of two goshalas were subjected to tuberculin test. Four buffaloes of the former herd and two cows in one goshala were found positive. Agglutination tests for brucellosis were conducted on 612 animals in organized herds and village herds, and 18 of these proved positive for infection. Outbreaks of coccidiosis and spirochaetosis in poultry were attended and necessary treatment rendered. Under a scheme, systematic survey with a view to finding out the disease conditions occurring in pigs was carried out in the districts of Hissar, Rohtak, Karnal, Sangrur, Patiala, Amritsar and Gurdaspur. Among contagious diseases, the incidence of foot-and-mouth disease was the highest, and the mortality caused by it was reported to be about ten per cent. Pasteurellosis and a type of pneumonia were also reported to occur in pigs. A peculiar type of disease with symptoms of shivering, moving in circles, coma, and sudden death was reported from the districts of Hissar and Rohtak. Sporadic cases of the disease occurred and the affected animals usually did not survive.

Thirty-four pigs were subjected to single intra-dermal tuberculin test using concentrated mammalian tuberculin in a dose of 0.1 cc. Two of these animals showed positive reaction characterised by oedematous and diffused swelling of purplish colour. In addition, 16 slaughtered pigs were examined at various slaughter-houses, but only one was found to show tuberculosis-like lesions in mesenteric lymph nodes. Histo-pathological studies confirmed these to be tuberculosis lesions, but the cultural examination and biological test failed to reveal acid-fast bacilli. Five cows of the Government Livestock Farm, Hissar, were reported to have aborted. Serum samples on agglutination test proved to be negative for burcellosis. The common parasites encountered in the pigs were *Ascaris*, *Ascarops*, *Oesophagostomum*, and *Trichuris*.

An outbreak of swine para-typhoid broke out among pigs of the Government Livestock Farm, Hissar. Cultures from the intestinal lesions and sub-maxillary lymph nodes were prepared and examined at the Indian Veterinary Research Institute. Of these, three cultures resembled *Alkalescens dispar* and one proved to be *Bact. coli*.

Rajasthan. Deficiency of vitamin 'A' was observed to cause much ill-health and deaths among cattle at Bikaner. Analysis of a few livers showed complete absence of vitamin 'A'. Survey to find out the incidence of bovine contagious abortion was carried out in 977 cattles, buffaloes and goats at different places. Only at Bassi, 59 animals out of 218 tested were found positive, and 15 gave doubtful reaction. In an outbreak of spirochaetosis in poultry, 344 birds were treated with penicillin and 155 with sulpharsenol. After treatment, 30 birds died in the penicillin-treated group and only one in sulpharsenol-treated group. Outbreaks of coccidiosis, salmonellosis, and avian leucossi complex were also recorded.

Kerala. Deficiency diseases due to various factors were encountered in bovines in different parts of the State. In poultry, fowl pox, Ranikhet disease, avian leucosis complex, salmonellosis, coccidiosis, and virus hepatitis were investigated and necessary measures for treatment and immunisation were undertaken. In goats, outbreaks of goat pox, contagious ecthyma, and ear mange were observed.

Mysore. During 1958-59, 677 pathological specimens were examined. On Government dairy farms 53 animals were tested for brucellosis and 13 were found positive. At two Government poultry farms, 932 birds were subjected to pullorum test. All were found negative, except one doubtful reactor. About 30 cases of bovine lymphangitis were studied and from ten of these organisms morphologically resembling *Pasteurella pseudotuberculosis rodentium* were recovered. A formalised vaccine prepared from organisms isolated from these cases was found to be effective in the treatment of affected cases. Sulphamezathine solution also gave encouraging results.

Uttar Pradesh (Sheep and Goats). Several outbreaks of immature amphis-tomiasis were encountered in sheep and goats in some districts of Uttar Pradesh during 1958-59. The average percentage of morbidity and mortality in sheep and goats was 16.08 and 50.19 respectively. The outbreaks were controlled by administration of carbon tetrachloride or hexachloroethane. Both the drugs were equally effective but sheep tolerated the former better than the latter.

The average percentage of deaths due to pneumonia among goats and kids came to 83.1 and 23.5, respectively. Parallel figures for adult sheep and lambs were 34.55 and 42.44 respectively. Pneumonia caused more deaths in sheep than in goats during the year under report.

C. pyogenes, *C. ovis*, *C. equi*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, and *Escherichia coli* were recovered from animals suffering from pneumonia. Cases of parasitic broncho-pneumonia in sheep and goats due to infestation with *Dictyocaulus filaria* and *Metastrongylus apri* were also encountered. The percentage of animals affected with blow-fly strike varied from 13.3 to 30 for sheep and 5.88 to 12.1 in goats. Blow-flies were collected and identified as *Chrysomyia spp.* Shearing, dipping, crutching and insecticides were used to control the disease. Infectious enterotoxaemia due to *C. welchii* types D and A was also met with. Lumbar paralysis was observed in 62 sheep and goats from September to December, 1958. Out of 45 affected cases treated with hetrazan only one succumbed to the disease and the rest made eventual recovery; whereas out of 17 untreated cases, 12 died. Caricide also gave encouraging results.

Himachal Pradesh. The scheme was sanctioned from 1st June, 1958. During the short period of three months a preliminary survey of contagious diseases was carried out. The animals of Cattle Breeding Farm, Kataula, were tested against tuberculosis and brucellosis. Out of these one animal reacted positively to the tuberculin test.

RINDERPEST ERADICATION SCHEME

This scheme continued to function in the States of Andhra Pradesh, Bombay, Orissa, Bihar, West Bengal, Assam, U.P., Punjab, Himachal Pradesh, Jammu

and Kashmir, Rajasthan and Delhi. Systematic vaccination of cattle and buffaloes was carried out in all the States by the special staff appointed under this scheme and a large area was rendered free from the disease. Except for highly susceptible hill cattle and cross-bred animals in Himachal Pradesh and Assam, Freeze Dried Goat Tissue vaccine was used. In all, over 222 lakh animals were vaccinated during the year as against 248.33 lakh in the previous year. During the year under report, the work in the States of Bihar, Andhra Pradesh, West Bengal and Assam showed decline and increased tempo of work was noticed in the States of Bombay and Madhya Pradesh. In few States in the completed areas "Follow-up Work" was also taken up.

To test the potency of vaccine in the field, tests in goats were made.

Freeze Dried Goat Tissue Vaccine was produced at six centres established under the scheme at Indian Veterinary Research Institute, Izatnagar, Lucknow, Hissar, Calcutta, Ranipet and Mhow. During the year under report, over 470 lakh doses of the vaccine were produced.

Due to decreased demand of FDGTV from the States, the production was reduced at Indian Veterinary Research Institute, Izatnagar and Ranipet Centres.

The Indian Veterinary Research Institute also produced Lapinised and Lapinised-avianised vaccine for protection of animals of high susceptibility.

Land Quarantine Stations. In order to check the ingress of the disease through the movement of animals from adjoining countries, Land Quarantine Stations have been established in the States of Uttar Pradesh, Bihar, West Bengal and Punjab. In all, 14 such stations are at present functioning.

Research on Rinderpest Vaccine. The scheme for improvement of various rinderpest vaccines to determine their keeping qualities continued to function at Indian Veterinary Research Institute. As a result of researches at Mukteswar, it has now been possible to take up production of lapinised-avianised virus on large-scale for use in the field at Indian Veterinary Research Institute, Izatnagar.

Statistical Study. A statistical study to assess the progress of the work done during the year brought out useful information with regard to percentage of cattle and buffaloes vaccinated and the average number of doses of vaccine used per 100 animals. As a result of this study, now ampoules containing less than 100 doses of vaccine are being issued from Indian Veterinary Research Institute. The study has brought out a clear picture showing the number of days in a month actually spent in vaccination work. This varies from State to State from 13 to 24 days per month.

International Co-ordination. An informal conference on rinderpest problems between India, Pakistan, Afghanistan, Nepal and Ceylon was held under the auspices of Food and Agriculture Organization at Karachi on 7th and 8th March, 1960. India was represented by Shri L. Sahai, Animal Husbandry Commissioner with the Government of India.

DAIRYING

The scheme for development and standardization of methods for detecting adulteration and determining major constituents of milk was started in 1958 at

Hoshiarpur, Punjab University. Under this scheme further work on the determination of inter-facial tension of milk and on the freezing point of milk was done during the year. A simple test for the determination of inter-facial tension of milk which could be used for detecting adulteration in milk was reported. Field trials of this test would shortly be undertaken.

Survey of Bacteriological Quality of Milk, Bombay. This scheme has been in operation since 1958. Under this scheme 2,894 samples were studied during the year for chemical and bacteriological quality. The data was studied with reference to source of milk sample, season, treatment, utensils, equipment, type of contamination etc.

From studies on raw milk at collection centres, it became obvious that high bacterial counts found in milk supplies received at the Union were due to high initial contamination during collection and bacterial growth during transport of milk.

Follow up work included trials to encourage the producers to use clean utensils for handling milk and to keep them covered; scalding water was used at collecting centres for cleaning utensils and chlorine water was used for rinsing. The quality of milk improved considerably by the adoption of these practices. The follow up work was extended also to primary societies.

Sterility test on dairy equipment indicated a high standard of cleanliness at the Union factory.

On the basis of statistical study of the data on quality of milk received by the societies and the Union, it was recommended to the Union that one hour M.B.R. time may be adopted for the initial stages as the acceptable time limit for milk in summer and monsoon and two hours in winter. It was also recommended that premium may be given for all milk which has M.B.R. time of about $3\frac{1}{2}$ hours.

In addition, preliminary studies on the standardization of conditions for the processing of milk, typing of the microflora in milk, effect of different heat treatments on bacteria and on bacteriology of milk power evaporated milk, condensed milk and butter production were carried out. These studies are in progress.

Survey of Bacteriological Quality of Milk, Allahabad. In this scheme, results of chemical and bacteriological study of 844 samples obtained from the different categories of milk supply in Allahabad city namely transporters, city producers, co-operative union and Institute of Agriculture were reported. The averages and ranges of the various categories were compared for milks of various categories of producers for various seasons; species of animal and time of production. The factors studied were titrable acidity, specific gravity, fat content, S.N.F. plate count, thermoduric count, methylene blue reduction time.

The collected data will be statistically analysed for drawing conclusions and making recommendations for extension work.

Survey of Bacteriological Quality of Milk, Delhi. Under this scheme, results of study of 2,234 samples of milk from the three collection centres of Delhi Milk Scheme at Mussori, Palwal and Muradnagar were reported. Samples were examined for organoleptic quality, temperature, alcohol test, acidity, ten minutes and one hour resazurin test, fat per cent clot on boiling test, 68 per cent alcohol precipitation test and methylene blue reduction time. Selected samples were tested for standard plate count, coliform contamination, thermoduric count and keeping

quality at 27° C. Considerable variations were found in the quality of milk produced at different centres. The reasons for these variations and the need for different processing required were studied. The results were very useful for the milk scheme.

Under the scheme a sampling test for carrying equipment for testing of milk at the time of collection of samples has been developed. A design for the construction of a laboratory on a trailer was also completed.

Pasteurisation of Milk to Destroy Pathogenic bacteria and improve Keeping Quality. This research scheme had been initiated at the N.D.R.I. in 1955 and was due to terminate in May, 1959. Under this scheme during the year 1958-59 the study of thermal destruction of pure cultures of important dairy micro-organisms suspended in different substrates and exposed to various pasteurisation temperatures was continued. Generally, all the organisms showed slightly greater resistance in ice cream mix than in other media, while greater destruction of cells occurred in the Holder method than in the H.T.S.T. process of pasteurisation. Among the organisms studied coliform bacteria were completely destroyed even at the lowest temperature of heat treatment (62·8° C/30 minutes and 71·1° C/16 seconds) except for a few survivors in the case of ice cream mix. *S. thermophilus*, *S. faecalis* and *S. liquefaciens* were more resistant and showed appreciable numbers of survivors after pasteurisation at 76·6° C/15 minutes and 82·2° C/16 seconds in all media starting with a low initial concentration. They were, however, almost completely destroyed at 82·2° C/10 minutes or 87·7° C/16 seconds. Cells of *B. cereus* did not seem to be affected by any of the time temperature combinations of heat treatment studied.

Effect of pH on the destruction of pure cultures were studied in milk and cream at 62·8° C/30 minutes. There was no appreciable difference in the number of survivors when pH was lowered from seven to five.

Some trials to study the influence of normal flora on the heat resistance of pure cultures were carried out. The normal flora growing in milk did not have any influence on the heat resistance of pure cultures of bacteria.

Thermal destruction of some human pathogens (*M. tuberculosis*, *E. typhosa* and *Shisella dysentery sonne*) were studied in milk (cow and buffalo) and cream of 30 per cent and 45 per cent. Cells of *M. tuberculosis* suspended in milk or cream of 30 per cent were completely destroyed when exposed to heat treatment by the Holder process (62·8° C/30 minutes) or H.T.S.T. method. But it survived in cream of 45 per cent heated upto 170°F/16 seconds. However, cells of *E. typhosa* and *dysentery* were destroyed completely when milk (cow and buffalo) was pasteurised by both the methods of heat treatment.

Further field trials were conducted at Aarey Milk Colony to study the effect of selected time temperature combinations of heat treatment for the efficient pasteurisation of market milk and the keeping quality of treated milk. The study reveals that there was no advantage in increasing the temperatures of pasteurisation beyond 165°F for 16 seconds in the H.T.S.T. process either from the point of bacterial destruction or improvement in keeping quality of milk.

Production of Dairy Sanitizers. Research work on this scheme commenced in 1955 at the N.D.R.I., Bangalore and shifted to Karnal in September 1958. The scheme terminated in May, 1959.

The object of the scheme was to test different cleaning materials and chemicals available in the country for their detergent efficiency for milk utensils and to evolve cleaning mixtures and procedures for adoption under different conditions.

The detergent properties and bactericidal efficiency of various cleaning mixtures were tested in relation to factors like *pH* of the sanitizing compound, temperature of exposure and the presence of organic matter. Based on the results of the above studies, the following three types of cleaning mixtures have been evolved for use under different conditions.

* *Cleaning-cum-sanitizing Mixtures (No. 7, 8 and 9) for use in Villages.* The influence of residual amounts of sanitizer on the quality of milk were examined by holding milk in the utensils washed with detergent-cum-sanitizing mixtures. It was observed that there was practically no inhibition on bacterial growth in milk held in the treated utensils and it was also seen that there was no appreciable change in the growth and acid produced by starter organisms inoculated into the milk held in the utensils. When the utensils were washed with a detergent and separately sanitized by rinsing with a solution of quaternary ammonium compound, there was slight reduction in the bacterial numbers as well as in the production of lactic acid by starter organisms indicating the inhibitory influence of residual sanitizer in the utensil.

The corrosive action of the cleaning powders on the metal tested (aluminium, tin and stainless steel) was negligible. The cleaning powder which contains sodium meta-silicate was found to be particularly satisfactory from the point of view of inhibiting corrosion on aluminium utensils.

A cleaning powder (DS-2) containing sodium sulphite and soapnut powder was mixed with Reh and used for cleaning the ghee tins in the form of a paste with the help of fibre or coir and then finally rinsed with clean water to remove all traces of the powder. The cleaning efficiency was particularly satisfactory when hot water was used for the final rinsing.

Another cleaning powder (DS-6) containing a good wetting agent used in the form of aqueous solution for cleaning the ghee tins gave satisfactory results.

Another scheme has been approved for field trials using the sanitizers evolved.

The scheme to standardize an accelerated oxidation test to determine the shelf life of ghee produced, packed and stored under various conditions.

The scheme was started at N.D.R.I. in the year 1958 with the object of evolving a combined accelerated test for induction period and peroxide development of ghee exposed to a rated current of oxygen which can be correlated with organoleptic score at varying intervals of shelf life of ghee produced from different kinds of market milk, manufactured by different methods and exposed to different practices of marketing and storage, etc.

During the year major portion of the programme of studies on the suitability of different tests on oxidisability index of freshly prepared laboratory samples of ghee have been completed.

* (A) Cleaning powder (No. 1 to 3) for use in dairies or milk collection centres.

(B) Cleaning powders (No. 4, 5 and 6) for use in villages.

A laboratory outfit consisting of a thermostatically controlled bath suitable for 8 tests for determining the induction period for oxygen absorption has been designed and got fabricated at the National Physical Laboratory, New Delhi.

Determination of induction period for oxygen absorption at an elevated temperature of 79°C has been observed to be helpful in predicting shelf life. Value for induction period of 20 hours and over appears to correspond to a marketable life of six months. Samples having an induction period below six hours have been found to be unmarketable. The above observations have been shown to apply to ghee samples prepared by the *desi* direct-cream and cream butter methods produced during different seasons of the year.

Study of Ghee Trade in U.P. The Committee was constituted by the I.C.A.R. with the object of going round the ghee producing and refining centres in Uttar Pradesh and for making necessary recommendations for the development of the ghee trade.

The Committee's report was considered by the Dairy Science Committee and the recommendations made by the Committee were endorsed for circulation to the States.

Scheme for the Sterilization of Milk, Cream and Sweetened and Flavoured Milk. The scheme commenced in 1958 at Aarey colony and is due to terminate in 1960. The object of the scheme is to study the various problems relating to the production and processing and marketing of the above products in India.

During the year under report, raw milk supplies from the winter season representing different bacteriological grades of quality and from bulk milk supplies received from Anand were standardized, clarified and sterilized.

All the trials except one gave satisfactory samples of sterilized milk which survived the incubation test at 37°C and 55°C. In one case where the M.B.R. time of the raw milk sample was only 45 minutes, the sterilized milk though satisfactory from the bacteriological point of view, gave slight grainy appearance.

There was practically no change in the bacterial count of sterilized milk during storage of four months. The storage was found to slightly affect the organoleptic qualities, viz., taste and flavour. The colour of milk became slightly more brownish especially when the storage temperature was high.

The specifications for 1/5th litre sterilized milk bottles have been prepared and suitable crown corks having fast lacquer and spotted diaphragm have been evolved.

The method for the production of eight different varieties of flavoured, coloured and sweetened milk have been standardized.

Preliminary costing on the processing and distribution of plain sterilizers and flavoured milk under the conditions as they exist at Aarey Milk Colony has been made.

ANIMAL NUTRITION

The Indian Council of Agricultural Research has established four Regional Animal Nutrition Stations at Bangalore (Southern Region), Haringhata near Calcutta (Eastern Region), Anand (Western Region) and Palampur (Northern Region) to study the nutritional problems of livestock in these regions. The reports

from Southern, Western and Eastern Regional Stations have been received. The work at Northern Regional Station in Punjab has only recently started.

Southern Regional Station, Bangalore. During the year under report the animal nutrition survey was carried out in Ongole tract of Andhra Pradesh, which is the original habitat of the famous Ongole breed of Cattle. One hundred and fifty samples of feeds and fodders and 64 samples of faeces were collected from the area and analysed. During the survey it was observed that grasses growing in the area comprised of many indigenous grasses, e.g., chippira gaddi (*Echinocola colonum* syn. *Panicum colonum*) chengala gaddi (*Chinnachne koenigii*), garika gaddi (*Cynodon dactylong*) thunga gaddi (*Fimbristillis quinquangularis kunth*), molava gaddi (*Dicanthium annulatum*). The protein content in these grasses ranged from 6.72 to 12.90 per cent. In addition to the above the following indigenous grasses were also observed.

Kunthur gaddi (*Ischaemum pilosum* wt.), thori gaddi (*Chloris virgata*), nanubala gaddi (*Paspalidium flavidum* syn. *Panicum flavidum*), gogada gaddi (*Chrysopogon montanus*), dona gaddi (*Brachiaria eroboiformis* grisab syn. *Panicum isachne* Roth), otha gaddi (*Setaria intermedia*) and gunugu gaddi (*Dactyloctenium aegyptium* Bealev. Syn. *Eleusine aegyptica* deuf.). The high protein content in these grasses varied from (5.1 to 8.6 per cent) and that of calcium 0.35 to 0.62 per cent.

Sunnhemp (*Crotalaria juncea*) and pillipesara (*Phaseolus trilobus*) were the important fodders of the area. The straws of variga ((*Panicum milcacium*), paddy (*Oryza sativa*) and jowar kadbi (*Andropogon sorghum*) were the dry fodders observed to be in use in the tract. It was observed that the common concentrates fed to cattle in the area were groundnut cake, gingelly cake, horse gram, rice bran, and gram husk. The average milk yields of cows per day were 7.48 lb. $\pm$ 0.114, 7.92 lb. $\pm$ 0.471 and 2.86 $\pm$ 0.762 during the monsoon, winter and summer season respectively. Corresponding figures for the buffaloes were 8.43 $\pm$ 0.030, 9.30 $\pm$ 0.337 and 6.27 $\pm$ 0.350 respectively.

The haemoglobin content of the cows, bullocks and buffaloes was found to be highest in the monsoon season. Clinical examination of animals in the surveyed area did not reveal any symptoms of dietary deficiency diseases.

An experiment conducted to study the effect of replacing 25 per cent of production ration (concentrates) by para grass on milk and butter fat production revealed that there was no difference in weekly milk yield, fat percentage and fat corrected milk yield between the experimental and the control groups of animals. Another study was also carried out to find out the effect of replacing 50 and 100 per cent cereal part of concentrate ration by tapioca on milk and fat production in cows. The experiment which was conducted on cross-bred animals revealed that the milk yield, fat corrected milk yield, fat percentage and total fat were not affected by partial or complete replacement of oats by tapioca.

Western Regional Station, Anand. During the study of the composition of fodders from Saurashtra, it was observed that the composition of cultivated jowar (*Andropogon sorghum*) fodder did not vary considerably from village to village in respect of samples collected from six villages in the region. Whilst a considerable variation in the crude protein content of the natural grasses was observed. A study of the composition at one, two and three months growth revealed that the crude protein and phosphorus content of the fodders decreased remarkably with the stage of growth.

The common grasses found in the area are baru (*Sorghum helpense*), dharo (*Cynodon dactylong*), drabh (*Sporobolus virginicus kunth*), ghaula (*Alysicarpus rogorus*), kagdoyo (*Heteropogon contortus*), karedi (*Apluda varia*), lampadu (*Aristida funiculata*), zinzvo (*Dichanthum annulatum*).

To study the resources of subsidiary feeds, samples of neem, pipal and tamarind leaves which were being used as fodder were collected and analysed from the different villages.

Among the three types of tree leaves studied in Saurashtra, neem leaves had maximum protein of about 15 per cent and maximum other extract above five per cent. While pipal (*Ficus religiosa*) leaves were richer in calcium having on an average 2.6 per cent calcium, and tamarind leaves were richer in phosphorus having about 0.21 per cent phosphorus. With regard to seasonal variation in the composition of these tree leaves it was observed that the leaves were generally richer in nutrients in winter than in the other two seasons. These were definitely least fibrous and quite rich in calcium in winter but were low in phosphorus content during that period.

During the haematological studies it was observed that the average haemoglobin content in the blood of village cows, buffaloes, bullocks and calves was found to be 9.0, 9.3, 10.2 and 10.7 gms. respectively.

Comprehensive animal nutrition survey was also undertaken in Rajasthan. Straws of bajra, maize, jowar and wheat, and grasses were the common roughages. Most of the animals were found to be inadequately fed. The average daily milk production was 5.0 lb. and 7.8 lb. for milking cows and buffaloes respectively. The milk yield of both the species was maximum in winter. The haemoglobin content in the blood of different categories of animals was found to be: cows 9.0, buffaloes 10.3, bullocks 9.6.

Cow calves 9.5, buffalo calves 9.9, sheep 7.6 and goats 7.3 gms.

Digestibility trials of jowar green, jowar hay and jowar silage were also carried out. Carotene contents of these were 2,760, 850 and 50 micrograms per 100 gms. dry matter respectively.

The analysis of different parts of banana plant carried out at the Centre showed that leaves were richer than the stems in crude protein, ether extract and calcium, but were lower in phosphorus. The composition of root bulbs was intermediate.

Cultivation of Russian Camfrey was introduced at this Centre. It was observed that while this variety was difficult to propagate by seeding, it could be easily established by planting setts. There was luxuriant growth during late monsoon and throughout the winter. It was, however, difficult to maintain proper growth in summer. The yield from the experimental plots was estimated at 15,000 lb. of green fodder with 2,000 lb. of dry matter per acre. The fodder though non-leguminous was rich in protein content, i.e., 19.89 per cent at flowering stage. The ether extract was 4.5 per cent, N.F.E. 41.93 per cent, crude fibre 7.72 per cent and ash 25.01 (phosphorus 0.62 per cent and calcium 1.29 per cent).

Eastern Regional Station, Hiraughata. A number of samples of feed grasses were collected at random from West Bengal area to confirm the findings made earlier with regard to their protein content which was found to be quite high in summer.

The incidence of dietary deficiency diseases was evaluated from detailed analysis of blood and liver samples collected from field animals as compared to the physiological and biochemical norms of different species like cattle, buffalo and goats (maintained in Haringhata Farm).

Anaemia was demonstrated in goats; it was microcytic and slightly hypochromic in males, macrocytic and hypochromic in females, microcytic and hypochromic in castrated goats. Ligocythaemia in female and leucopenia in both male and female goats of field were present.

The blood sugar contents in field animals, obtained during slaughter, were higher than that of normal animals from which samples were collected after overnight fasting. Ca, Mg inorganic and total P and protein levels were lower in field animals than in farm cows and buffaloes. The blood copper levels in farm and field animals demonstrated copper deficiency in the latter.

The sedimentation rate of buffalo blood was considerably greater than that of the goat and cattle blood.

Studies on Influence of Trace Elements on Health and Productive Capacity of Livestock, I.V.R.I. The scheme which was started in March, 1952, continued to function at the I.V.R.I.

During the year under report, studies were conducted on the effects of feeding large doses of manganese on the utilization of feed, copper and cobalt. It was observed that nitrogen metabolism was not significantly affected by high manganese ingestion. On the other hand, the retention of lime and phosphoric acid was considerably influenced by such high intake of manganese as 500 ppm. At that stage the positive balances were turned into negative.

During the year under report, deficiency surveys were also conducted at four livestock farms, viz., Khanapara (Gauhati), Upper Shillong and Dibrugarh in the State of Assam and Haringhata in West Bengal. At Khanapara, it was observed that 30 per cent of the animals had a sub-normal haemoglobin content. At Upper Shillong and Dibrugarh Farms, the percentage of animals with sub-normal haemoglobin values were 50 per cent and 10 per cent respectively. A study of blood cell diameter revealed that in the case of cow calves and buffalo calves it was smaller than that of their dams, the average values being $6.02\mu \pm 0.39$ for cows calves and $5.59\mu \pm 0.53$ for buffalo calves. The average values for the respective dams was $6.4\mu \pm 0.41$ for cows and $6.55\mu \pm 0.2$ for buffaloes. Based on 80 animals it was observed that R.B.C. count in respect of calves was also higher than that of respective dams. Widespread parasitic infestation in at least two of the three farms surveyed, viz., Khanapara and Upper Shillong was indicated by the very high W.B.C. count recorded in animals at these farms. About 60 per cent of the animals showed a low copper value and a sub-acute type of deficiency.

Nutritional Requirements of Buffaloes, B. R. College, Agra. The work under the scheme started on the 23rd June, 1958. Experiments conducted to estimate the minimum and maintenance protein requirements of buffaloes showed that the minimum protein requirements were 0.245 lb. D.C.P./1,000 lb. body weight. As regards the maintenance protein requirements, the results of the first balance trials conducted after a month's feeding to ascertain the nutrition adequacy of the ration showed positive nitrogen balance in 0.45 lb. D.C.P. level and a negative balance

at 0.40 lb. and 0.35 lb. of D.C.P./1,000 lb. body weight on 24 male buffaloes. These trials further revealed that the ration as a whole was deficient in respect of both Ca and P. To meet the deficiencies supplementation of the ration (that consisted of wheat *bhusa ad lib.* rape cake supplemented with shark-lever oil) with CaCO_3 and monosodium phosphate had since been started and the work was in progress.

Scheme for Further Work on Paddy Straw. The work on this scheme started in November, 1954. Previously, experiments were carried to process the paddy straw with a view to remove the inherent disabilities met within its feeding to livestock. Lime treatments and washing of paddy straw before feeding was recommended. The washing of the straw resulted in a reduction in the content of total ash, crude protein, crude fat, phosphorus, potassium and oxalates, while an increase was observed in the case of calcium and crude fibre. During the year under report, investigations were carried out on feeding of untreated straw with or without supplement of berseem hay and calcium carbonate. It was observed that on supplementation of untreated straw ration with two ounces of calcium carbonate daily, the marginal positive balance of calcium was obtained. The animals fed on lime-treated paddy straw showed a very high negative balance for calcium showing detrimental effects of this treatment. Supplementing the feeding of paddy straw with a high dose of common salt also did not give any beneficial effect. The work under this scheme which started on the treatment of paddy straw is now confined to supplementing the same on the calcium carbonate. The final report is expected shortly.

HIDES AND SKINS

At the Central Leather Research Institute, Madras, a number of schemes financed by the Indian Council of Agricultural Research have been in operation for last few years for research in the improvement of leather, hides and skins.

Manufacture of Chrome Retan Leather. The scheme had been in operation from the 26th February, 1954, to the 25th February, 1959. The object of the scheme was to develop suitable processes for the manufacture of chrome retan leather used as uppers in heavy boots for use by the army and the police, as by chrome tanning alone it was not possible to get the leather of required specifications.

The work conducted under the scheme revealed that the reasons for crackiness were (i) the use of vegetable tanning material having higher amounts of non-tans, resins, and mucilages, which on decomposition on the ground layer produced a tendency to crack on folding, (ii) free acidity of the leather on aging, and (iii) insufficient and improper fat liquor leading to crackiness. Accordingly, investigations were conducted to minimise those defects and to obtain a product of desired qualities.

A technique for the manufacture of chrome retan leather from inferior cow hides has been worked out. By the retan process it became possible to produce thick leather from thin hides. The retan process also imparts fullness and better feel to the leather, absorbs more fat liquor, and gives a suitable embossing. Comparison of the chrome leather with that of retan leather by chemical and physical

tests showed that the tensile strength, tongue tear, stitch tear, and grain crackiness of chrome leather fall in close agreement with that of retan leather. Hence, by improving the quality of the leather the wearing qualities were not much affected. The cost of production, including the chemicals used, labour etc., worked out to 65 to 75 nP. per square foot as compared to 60 to 65 nP. for full chrome leather. In the production of civilian upper leather by retanning, the cutting value was increased but a better feel to the leather with a fine grain was imparted.

Improvement of Quality of Shoe-uppers and Industrial Leather Manufactured by Mineral Tannage. The work under the scheme commenced on the 18th January, 1954. During 1958-59, leather shavings reduced and sawdust reduced liquors were prepared in the open and analysed.

Tanning tests were carried out with chrome liquor masked with sodium acetate, citrate, formate, phthallate, and tartrate in the proportion of 0.25 mol./mol. of chromium oxide. Experiments were carried out on hide power with different proportions of masking salts and the most suitable proportion was adopted for tanning tests. Of these five salts, the formate, phthallate, and tartrate gave good results. The application of syntan as a pretanning and retanning agent in combination with chrome was also tried.

Manufacture of Fat Liquors for Leather Production from Indigenous Raw Materials. The Scheme is working since the 20th February, 1954, with the object of manufacturing fat liquors from Indian oils to make the Indian tanning industry self-sufficient in respect of these essential treatment materials. During 1958-59, studies were concentrated on the use of neats-foot, coconut, tobacco seed, and fish oils for sulphation and use as fat liquors. The various sulphated oils prepared were analysed by the older traditional methods as well as the modified non-aqueous titration techniques developed at the C.L.R.I. These sulphated oils have also been tested for their fat liquor effect, alone and in blends with other oils, for different types of leather. Sulphated fish oil was also sent to different tanneries for testing and reporting, and the reports are all satisfactory.

It is proposed to complete the pilot plant production for standardisation in respect of coconut, tobacco-seed oil, neats-foot oil and rice-bran oil reported earlier and to work out their costing in the very near future.

Manufacture of Leather Boards from Tannery Waste Materials like Leather Shavings and Cuttings. The scheme commenced on the 22nd March, 1959. The object of the research is to utilise the waste leather shavings and cuttings of tanneries, shoe factories, and leather goods manufacturing concerns in making leather boards for use in the manufacture of shoes and some cheap leather goods.

Processes have been worked out to turn out satisfactory boards during the year under review and the pilot plan operation was in full swing. It is proposed to release the standardised processes for commercial exploitation through an open demonstration very shortly.

PISCICULTURE

Research on Fish Ecology, Uttar Pradesh. The scheme started functioning in the Department of Zoology of the Lucknow University from August, 1958. During

the period under report, regular observations were made on the species of fish, their gut contents, and food habits. The species of the fish collected and identified from Uttar Pradesh were 62 in number.

Of the herbivorous fishes, *Catla catla* had high plankton diet and was found to be a surface and column feeder: *Labeo rohita* was essentially a column feeder, although it preferred lower strata of the water; whereas *L. calbasu*, and *L. bata* were both bottom feeders: *Puntius sophore* and *Amblypharyngodon mola* and *Mastacembelus armatus* were column plankton feeders; while *Ambassis nama* and *Colisa fasciatus* were surface plankton feeders. The carnivorous fishes, *Clarias batrachus*, *Ophicephalus marulius* and *O. strajatus*, were all bottom predatory feeders; while *Wallagonia attu* was a predatory column feeder. Of the other carnivorous, *Rita rita* was a special bottom feeder, which fed mostly on bottom-dwelling invertebrates.

The qualitative results for plankton showed wide variations in occurrence and in the species during the different months of the year. There has also been observed a difference in the occurrence of common species of fishes in the eastern and western districts of Uttar Pradesh.

Hydrobiological and Faunistic Survey of the Godavari Estuarine Systems. The scheme was started from 1st August, 1958. The field station of the scheme is at Yanam, East Godavari District, Andhra Pradesh. The object of the scheme is to make a comprehensive and systematic survey of the hydrobiological conditions, plankton, bottom fauna, shell fisheries, and fisheries of Godavari estuarine systems. During the period under report an exploratory survey of the hydrology, plankton, bottom fauna, and fisheries of the lower reaches of Gautami and the Kakinada Bay were undertaken. Routine collections of samples were made from selected and representative stations in the area covered, and the data were analysed. The effects of the continuously changing hydrographical conditions in the estuary and their effects on the qualitative and quantitative aspects of plankton and fisheries were given due attention. The Kakinada Bay was selected for an intensive study of the bottom fauna. Routine collections of fishes and prawns were made from the landing villages and these have been mostly identified. Investigations on the biology of the more important food fishes were in progress. The shell fisheries, in which the estuary is very rich, were also receiving particular attention.

APICULTURE

Regional Bee Research Station, Coimbatore. The scheme started from December, 1951. Investigation of the possibilities of increasing the honey-yielding capacity of the Indian bee (*Apis indica*) by selective breeding and of certain fundamental as well as practical aspects of bee-keeping were envisaged. During the year under report, 27 pedigreed queens were raised, of which 22 queens hatched the various colonies along with seven queens of the previous year. Further observations were made on the influence of weather on nectar secretion and its concentration. Among the flowers studied drumstick was found to be a dependable source of nectar throughout the year, but the average concentration of nectar varied from 12.7 to 62.0 per cent, being high during the months when the temperature was high. In *Gliricida* the concentration varied from 24.7 to 56 per cent, and in cotton and banana from

6.7 to 44.0 per cent and 6.2 to 22.5 per cent respectively, and the weather had little influence on the concentration of nectar in these cases. Tamarind showed a concentration of 80.5 per cent and *Jaccuementia voilacea* from 15 to 40 per cent. The quantity of nectar was found to be too little in the case of lucerne, gingelly, horse gram, *Antigenon*, etc.

Specimens of workers from poor and good yielding colonies were taken up for biometric studies. The data obtained revealed that there was no significant difference in the case of important parts measured with respect to strong and weak colonies.

Investigation on pollen substitutes were conducted and it was found that there was steady increase in brood or pollen stocks in the colonies treated with water extracts of flours of Bengal gram and green gram during the lean season from July to October. But there was no indication that the bees preferred legume flours to sugar syrups as the response in the case of sugar syrups also was equally good. Work on swarm prevention was carried out and it was noticed that inter-changing methods gave promising results.

CHAPTER IV

Statistical Research

THE Statistical Wing of the Indian Council of Agricultural Research has been carrying on the work of a full-fledged research and training centre for a number of years. With a view to give it an appropriate name descriptive of its functions, the Government of India redesignated it as the Institute of Agricultural Research Statistics.

Advisory Work. The Institute of Agricultural Research Statistics (I.C.A.R.) has been dealing with its advisory work on statistical aspects relating to the design and layout of agricultural and animal husbandry experiments and the interpretation of their results, examination of the technical programme, annual progress and final reports of the Council's schemes and the scrutiny of statistical papers received for publication in the Council's Journals. A large number of other statistical enquiries received from the Food and Agriculture Organisation of the United Nations, the various Departments in the Central and the State Governments, the Commodity Committees and other Institutions were also attended to.

RESEARCH

Chinese Method of Paddy Cultivation. With a view to judge the efficiency of Chinese method of paddy cultivation compared with that of Japanese and local improved methods of paddy cultivation practised in India, well designed experiments have been laid out at 31 research stations located in the major rice-growing States in the country during 1959-60. Data from 16 centres have so far been received for statistical examination and those pertaining to other centres are expected to be received shortly. The statistical analysis of the data already received is in progress.

National Index of Field Experiments. The scheme was started by the Council in October, 1955 with the object of collecting and maintaining at a central place the records of all the field experiments conducted in the country since 1935. Details of the experiments together with the results, regarding their layout, treatment, averages and standard errors are being recorded on specially prepared Index Cards. It is proposed to prepare compendia of field experiments conducted during the periods 1935-47, 1948-53, 1954-59 in three volumes. The first volume covering experiments during 1948-53 is under preparation and compendium for the period 1954-59 will be taken up thereafter. During the year under report, the collection

of data pertaining to the experiments conducted during 1948-53 was completed for all the States except Bihar. The number of experiments so far reported for inclusion in this compendium is of the order of 6,800. Besides the above, data pertaining to approximately 2,400 experiments conducted during 1935-47 and 4,700 experiments conducted during 1954-59 have also been collected by the Council's staff under the scheme.

Pilot Study of the Incidence of Pests and Diseases on Rice Crop in Orissa. With a view to evolving a suitable sampling technique for the estimation of the incidence of major pests and diseases on rice crop and to study the nature of their relationship with yield, a pilot study was initiated in Cuttack district on the first crop of rice in June, 1959. The data received from this pilot study is under statistical examination. This study has been extended to cover the adjoining areas of the Puri district during the second crop season (December to April).

Analysis of Long-term Experiments. During the year under report, long-term manurial experiments conducted on sugarcane crop at Copergaon, Akluj, Deolali, Padegaon and Muzaffarnagar and a rotational experiment conducted with the main crop of maize at Pusa were analysed. Compost, nitrogen, phosphate and potash all gave significant responses at Padegaon. Response to mixture of ammonium sulphate and groundnut cake was higher than ammonium sulphate alone at Copergaon, Akluj and Deolali and Padegaon. There was a decreasing trend in the yields of all the plots which were checked by the application of compost. At Muzaffarnagar nitrogen from all sources gave significant responses. At this centre also, there was a decreasing trend in the yields of plots treated with ammonium sulphate, groundnut cake and their mixture; the reduction in the yield was largely checked by the application of farmyard manure. At Pusa, farmyard manure and rape cake gave good responses for all crops. In addition, the responses of maize, oats and wheat to NPK and those of peas and gram to phosphate were high.

Model Agronomic Experiments. Nine types of complex factorial experiments on manurial, cultural, rotational and irrigational problems are being conducted at 30 centres spread over the country. At each centre, blocks of 15 acres are taken on lease from cultivators to carry out the experiments.

Besides the yield data, information on a number of growth factors are also being collected from the experimental plots. During the year 1958-59, 179 experiments were conducted and the number of experiments planned in 1959-60 was 181. During the year under report, the statistical analysis of 87 experiments conducted during *kharif* 1957-58 was completed and a report prepared. The results indicated that response of paddy to 20 lb. per acre of nitrogen varied from half a maund to four maunds per acre, except for Karjat centre where the response was about seven maunds per acre. The average response over all centres was 2.1 maund per acre. The response of paddy to 20 lb. P_2O_5 per acre was on an average 1.5 maund per acre. Increase in the dose of nitrogen resulted in higher yield in most of the centres while the additional yield when the dose of phosphate was increased beyond 20 lb. P_2O_5 per acre was practically negligible. Application of potash to paddy did not show any response. Different times of application of nitrogen to paddy crop gave more or less similar responses. At all the centres, the average

yield for early planting was higher than that for normal planting dates. The spacing of 10 in. $\times$ 10 in. was found to be the best or at least as good as the other closer spacings tried. The relative merits of two, four, and six seedlings per hole differed at different centres.

Simple Fertilizer Trials on Cultivators' Fields. During 1959-60, retraining of field staff under the scheme was carried out in the States of Andhra Pradesh, Madras, Rajasthan and Bihar. The statistical analyses of over 4,800 experiments conducted in 87 districts during 1958-59 were completed and the report is under preparation. During the year 1959-60 about 8,000 experiments were conducted in the States of Andhra Pradesh, Assam, Bihar, Delhi, Himachal Pradesh, Kerala, Madras, Mysore, Orissa, Rajasthan, Punjab, Uttar Pradesh and West Bengal.

Fertilizer Demonstration Trials. This scheme was initiated in the year 1954 in collaboration with the Technical Co-operation Mission of the U.S.A. with a view to popularise the different types of inorganic fertilizers produced or planned to be produced in the country. During the year under report, data pertaining to 2,000 demonstrations conducted in *kharif* 1957-58 and about 1,000 demonstrations conducted in *rabi* 1957-58 were summarized and reports prepared. Besides, two supplementary notes summarizing the results of 5,000 demonstrations conducted in Uttar Pradesh during *kharif* 1955-56 and about 6,000 demonstrations conducted in Andhra Pradesh in the same season respectively were prepared. The results obtained during *kharif* 1957-58 indicated a response of about six maunds per acre of paddy to the application of 210 lb. of fertilizer mixture per acre.

Yardsticks of Production. In pursuance of the recommendation of the study group on Agricultural Production appointed by the Planning Commission, the Institute of Agricultural Research Statistics (I.C.A.R.) undertook a study of all the available data on the following items:

- (1) Response of green manure on rice and wheat
- (2) Response of F.Y.M. or compost obtained in field experiments on rice and wheat.
- (3) Fertilizer responses of important cereal and cash crops.
- (4) Results of irrigation experiments on wheat.

The summarization of the large body of the data involved the use of intricate statistical techniques, since the pattern of experiments and the doses tried varied considerably. In order to obtain estimates of responses of standard doses, response curves were fitted in a number of cases and responses to varying levels actually tried were converted to that for the standard dressing.

The results obtained indicated an average response of 2.4 maund/acre of rice and 1.9 maund/acre of wheat for the application of 5,000 pound/acre of green manure. The responses obtained for five tons per acre of F.Y.M. or compost were 1.7 maund/acre and 2.2 maund/acre of rice and wheat respectively. The additional yield due to irrigation was estimated as six to eight maund/acre for both rice and wheat. Response to twenty pound/acre of nitrogen was of three maund/acre for rice and irrigated wheat. Phosphate response was on an average lower than that of nitrogen being about 2.5 maund/acre for rice and two maund/acre for wheat for the level of 20 pound P_2O_5 /acre. Moderate to good responses were also obtained for fertilizer application to sugarcane, cotton, jute, groundnut and gram.

STATISTICAL ANALYSIS

STATISTICAL ANALYSIS OF DATA COLLECTED UNDER THE SCHEME
FOR THE SURVEY OF BACTERIOLOGICAL QUALITY OF MILK, DELHI

As reported earlier (ref. Annual Report, 1958-59), the scheme started functioning at Delhi from July, 1957. One of the studies to be undertaken is the assessment of bacteriological quality of raw milk reaching Delhi with a view to deciding upon acceptance standards for milk to be of use to the Delhi Milk Supply Scheme. The statistical analysis of the data collected during March, 1958 to February, 1959 was carried out at the I.A.R.S., of the Council. The samples studied were of (i) raw milk from individual agents bringing milk to three collection centres viz. Masori, Muradnagar and Palwal and (ii) of milk collected under (i) and stored for 24 and 48 hours at 3.5° C. The data related to various tests carried out for determining the bacteriological quality of milk.

(i) *Raw Milk from Individual Agents.* Appropriate statistical analysis of the data pertaining to raw milk samples from individual agents revealed that the Methylene Blue Reduction (M.B.R.) time, Standard plate count, Thermoduric count, Resazurin one hour and ten minutes reading, acidity and fat content differed from centre to centre as well as from season to season. It was seen that the samples from Palwal and Muradnagar were generally of an inferior quality in regard to all characters as compared to those from Masori. For example, the average M.B.R. time was about two and half hours in the case of samples from Masori while it varied from 45 minutes in monsoon to two hours 45 minutes in winter for those from Muradnagar and half an hour in monsoon to two hours in winter for those from Palwal. For the samples from Muradnagar and Palwal the average M.B.R. time was very low during summer and monsoon varying from 30 to 50 minutes. Similarly, the average standard plate count varied from 0.53 million in winter to 1.22 millions in summer for Masori samples while the corresponding figures were 1.03 millions to 10.82 millions for Muradnagar and 2.20 millions to 34.31 millions for Palwal. Acidity ranged from 0.10 in winter for Masori to 0.15 in summer for Palwal. The average values for Thermoduric count, Resazurin one hour and ten minutes disc readings for various seasons and centres ranged from 7.59 to 48.32 thousands, 0.1 to 3.5 and 2.4 to 5.6 respectively. However, it is to be pointed out that during winter, samples from Muradnagar are of a superior quality compared to even those from Masori. From a study of the effect of distance of source of milk from the collection centre on the quality of milk, it was seen that in case of samples from Masori the quality of milk as revealed by the M.B.R. time and Resazurin one hour and ten minutes readings deteriorated significantly as the distance of the source of milk from the collection centre increased. The decrease in Resazurin disc readings was noticed to change from season to season. In the case of samples from Muradnagar significant differences were noticed in Resazurin ten minutes reading whereas samples from Palwal showed significant changes in Resazurin one hour reading.

(ii) *Raw Milk Samples Stored for 24 Hours and 48 Hours.* It was seen from an analysis of the data that storage for 48 hours at 3.5° C resulted in significant decrease in M.B.R. time and Resazurin one hour reading in case of summer samples from Masori and significant increase in acidity in case of monsoon samples from Palwal.

The average M.B.R. time of summer samples from Masori after storing for 24 hours and 48 hours were 146 and 131 minutes respectively and the Resazurin one hour disc reading was 3.5 and 3.1 respectively. For other cases the results indicated that there was no significant deterioration in the quality due to storage even up to 48 hours compared to the initial quality of the milk in any season.

STUDIES ON SAMPLING OF DAILY MILK RECORDS FOR ESTIMATING LACTATION YIELDS OF COWS

With the objectives of (i) evolving a suitable sampling procedure for milk recording and developing an efficient method of estimation for assessing the average lactation performance of a group of animals and (ii) examining the possibility of adopting a rational scheme of supervision on the recording of milk yields of experimental animals, the daily milk records of cows maintained at Government livestock farms were studied in 1958-59. Further studies were continued during the year.

The efficiencies of the procedures of recording (i) the milk yield of cow on one randomly selected day in a week and (ii) two randomly selected days in a fortnight relative to the (iii) systematic recording of milk yields at weekly intervals were examined and the latter procedure of recording was found more efficient apart from being more convenient and simple in adoption.

Additional data on milk yields recorded under village conditions in the large scale enquiries for estimating the cost of milk production in Delhi and Madras States were studied and the results thereon confirmed the earlier findings based on farm data.

For basing selection of calves in Key Village Scheme on the milk production of their dams, it is necessary to secure the minimum data on the milk produced by each dam with a calf eligible for selection.

Ranking of animals on the basis of recording at systematic intervals of four or eight weeks throughout the lactation was found to be extremely efficient, the rank correlation being more than 0.9 and about 0.85 respectively for the two intervals. Records of the milk yield on only three days spread over the first 24 weeks were found to provide a more reliable basis for ranking than that provided by the recording of yield on all the days upto the peak which extends to 100 days in some cases.

The rank correlation based on the same number of recordings per animal in 24 weeks could be further increased by suitably shifting of the 24 weeks period of recording. The optimum 24 weeks period observed in the majority of cases was 9 to 32 weeks.

Recording on four days at intervals of six weeks during the 24 weeks of lactation of an animal commencing from the ninth week was found to provide a very satisfactory basis for ranking.

A suitable procedure is being developed for sample recordings of milk yields in the Key Village Scheme which would provide an objective method of selection of calves on the basis of the milk production of their dams. At the same time, the suggested procedure will provide an estimate of the annual milk production in the Key Village Block as well as the average lactation yield per animal, the two indicators necessary for assessment of the progress of the Key Village Scheme.

ANALYSIS OF BREEDING DATA PERTAINING TO THARPARKAR HERD, PATNA

At the instance of the Department of Animal Husbandry, Bihar, a rapid analysis of the data relating to lactation yield and lactation period on Tharparkar herd, Patna was taken up. A report on the results obtained was submitted to the Scientific Committees of the Council in March, 1956. For making the statistical study comprehensive as was done for other herds, further studies were taken up during the year. The items of study covered so far include yield per day of lactation, calving interval, yield per day of calving interval, age at first calving, the estimates of heritability and repeatability coefficients for these characters. The analysis is still in progress and is likely to be completed by the end of June, 1960.

STATISTICAL STUDIES ON CROSS-BREEDING AND BUFFALO DATA
AT THE MILITARY DAIRY FARMS

The I.A.R.S. has been undertaking studies on breeding data accumulating in the livestock farms of the Central and State Governments and other livestock research institutions in the country. The data so far examined related only to pure breeds of cattle.

Recently, cross-breeding has assumed topical importance in view of the Council's changed policy of encouraging of low producing cattle in hilly and heavy rainfall areas and of promoting investigations on the possible evolution of a new breed from crosses of a recognised Indian breed with a suitable foreign breed. The study of past data relating to cross-breeding will be of great value in this context. Extensive data of such nature are already available at a number of military dairy farms.

Steps have been taken to secure the data. A preliminary examination of the available data for their adequacy and suitability has been made. The data available at individual farms were found to be inadequate for critical statistical studies, but that collated over all the farms under the Western command is sizeable and would pertain to roughly 900 cross-breds. Besides, the breeding data relating to buffaloes in the military farms were examined and found suitable for analysis. Arrangements have been made to obtain the relevant registers from these farms. Already the data have been received from one of these farms and the compilation of the same is in progress.

STATISTICAL ANALYSIS OF DATA COLLECTED UNDER THE INDIGENOUS
GOAT BREEDING SCHEME, HISSAR, PUNJAB (1939-57)

As reported last year, the data collected under the Council's Scheme at the Government Livestock Farm, Hissar upto the end of March, 1957 are being analysed at the Institute of Agricultural Research Statistics. Some of the results obtained such as those regarding mortality, overall changes in the characters from generation to generation, heritability for first lactation yield and the best season for mating goats have already been reported last year.

Further studies on the estimation of repeatability coefficient for different characters, heritability estimates for characters other than lactation yield and birth weight, effect of multiple kidding on lactation yield, effect of order of lactation, genetic advances etc., are nearing completion and the results thereof will be presented at the next Committee Meetings.

STATISTICAL ANALYSIS OF MILK COMPOSITION DATA

Data on butter fat content, solids not fat content and specific gravity of genuine milk samples from individual cows and buffaloes were collected from the States of Bihar, Punjab and West Bengal, to make an objective study of the problem of reviewing the prescribed standards for market milk. The consolidated report on the statistical analysis of the data was presented to the Scientific Committees Meetings of May, 1960. The salient features of the report are given below:

The differences between the average values of each of the three characteristics for the different regions were found to be highly significant for cow as well as buffalo milk. Regarding variability from sample to sample milk from both cow and buffalo showed the same order of magnitude of the coefficient of variation, the value of fat being over 20 per cent for solids not fat about seven per cent and specific gravity less than 0.3 per cent. The analysis revealed significant variation between the seasonal means. There was no consistency on the differences between the two times of milking.

The percentage of genuine samples from individual animals falling below the official standards was as high as 40 for the different characteristics of cow and buffalo milk in Bihar while it was rather low in West Bengal. The pattern of differences estimated for bulk samples from data for individual samples remained the same even though the rejection percentages decreased considerably as the herd size increased.

The tolerance limits estimated for milk of individual animals varied in the different regions. The limits were found to be generally higher for West Bengal than those for other regions. The tolerance limits were found to vary in different seasons as well, the values for summer being in general lower than those for the other two seasons. The same nature of variation was observed in the case of the limits for milk from herds of varying sizes as worked out from individual samples. It is necessary that these regional and seasonal variations are properly taken into account while fixing the quality standards for market milk to maintain a constant producers' risk.

SURVEY FOR ESTIMATING THE COST OF PRODUCTION OF MILK IN CALCUTTA

The object of the survey is to test out the sampling technique for assessing the cost of production of milk evolved by the Council in different parts of the country where the conditions obtaining differ. The present survey is being carried out in the urban and suburban areas of Calcutta city and rural areas of West Bengal.

The scheme commenced on 1-12-59 and the work of training of field staff and the house to house in the whole of urban area of Calcutta and the 24 selected villages each in the suburban areas of the city and the rural area of

Chandranagore sub-division in Hoogly district was completed by the beginning of March. The detailed enquiry regarding the factors pertaining to the cost of production of milk commenced on the 14th March, 1960 and will continue for a period of full two years. Fifty-four randomly selected households containing milch cows and buffaloes (called stables) in the urban area of Calcutta, 96 stables in the 24 selected villages in the suburban areas and another 96 stables in the 24 selected villages in the rural area are being visited one day each week by specially trained investigators for collecting the requisite data on milk production and various components of its cost. Data on milk and feeds are collected by direct weighment and other items such as wages of labour, price of feeds, recurring expenditure etc., are recorded through observation and enquiry.

During the period under report, the field work pertaining to the Madras survey was completed by November, 1959 and the second progress report (analysis of data of the first year of enquiry December, 1957—November 1958) is being presented to the Scientific Committees of the Council to be held in May, 1960. Some of the important results obtained are as follows:

1. The net cost per seer of milk in all the three areas was found to be of the same order, viz., 69 nP. When the cost of family labour is excluded they worked out to be 63 nP. in the urban, 53 nP. in the suburban and 39 nP. in the rural area.

2. Feed formed the largest item of cost amounting to about 66, 55 and 49 per cent of the gross cost of milk in the three areas. If family labour is excluded from gross cost, the percentages worked out to be 70, 71 and 84 in the three areas.

3. The cost due to depreciation on animals accounted for 19, 9 and 6 per cent of the gross cost in the urban, suburban and rural areas. Unpaid labour accounted for 7, 23 and 41 per cent of the gross cost in the three areas.

4. There was no material variation in the net cost in the three seasons in the urban and suburban areas but in the rural area it was highest in winter and lowest in summer.

5. The net cost excluding unpaid labour per seer of cow milk was estimated to be 61, 91 and 51 nP. in the three areas. The corresponding estimated costs for buffalo milk were 63, 39 and 32 nP. respectively.

6. The average milk yield per day per milch cow was estimated to be 3.21, and 0.30 and 0.50 seers in the three areas and for milch buffalo it was estimated to be 3.00 and 1.16 and 1.03 seers. The average percentage of butter fat was about four in cow milk and seven in buffalo milk.

7. The net cost per seer of milk was found to be lowest for the large size stables in the urban area and the non-cultivator commercial type of producers in the suburban and rural areas.

8. It was observed that in the urban area a cow and buffalo are maintained on an average on 8 lb. of concentrates, 10 lb. of dry fodder and only about half a pound of green fodder. In the suburban area the amount of feeding for a cow was half a pound of concentrates, 6 lb. of dry fodder and 1 lb. of green fodder whereas a buffalo was fed on an average 2 lb. of concentrates, 7 lb. of dry fodder and 4 lb. of green fodder. In the rural area the feeds worked out to 1 lb. of concentrates, 8 lb. of dry fodder and 9 lb. of green fodder for a cow and 2 lb. of concentrates, 9 lb. of dry fodder and 11 lb. of green fodder.

ASSESSMENT OF PROGRESS OF WORK IN THE RINDERPEST ERADICATION SCHEME

The assessment of progress of work under the Rinderpest Eradication Campaign was carried out from the weekly returns received in the prescribed proforma from the field staff working in the States of Bombay, Andhra Pradesh, Orissa, West Bengal, Bihar, Uttar Pradesh, Punjab, Jammu and Kashmir, Himachal Pradesh, Assam, Rajasthan, Madhya Pradesh and Delhi where the scheme was operating during 1958-59. A number of important indicators of the operational efficiency of the campaign such as the percentage of animals vaccinated in the areas covered, the extent of wastage of vaccine in the field and the average rate of out-turn of work per individual were worked out besides estimating the total number of vaccinated animals.

The number of animals vaccinated during 1958-59 by the field staff working under the campaign was 171 lakhs. An additional 31 lakh animals were reported to have been vaccinated by the same staff for which no returns were received. About 47 lakh vaccinations were also reported to have been carried out by the normal departmental staff in various States.

The percentage of animals vaccinated in the villages varied from 63 in Bombay to 94 in Orissa, against an overall average of 81.

On an average 125 doses of vaccine were used for vaccinating 100 animals. The wastage of vaccine was highest in Uttar Pradesh (40 doses per 100 animals) and lowest in Punjab (13 doses per 100 animals).

The overall average number of vaccinations per individual per week worked out to 311, varying from 136 in Himachal Pradesh to 567 in Punjab.

An analysis of the working pattern of the field staff in the States of Jammu and Kashmir, Punjab, Uttar Pradesh, Madhya Pradesh and Rajasthan was also carried out to determine the various factors influencing the progress of work.

STUDY OF MILK YIELD, BREEDS FEEDING AND MANAGEMENT PRACTICES
OF CATTLE AND BUFFALOES, (1959-60)

The Indian Council of Agricultural Research has been undertaking since 1956-57 a series of pilot sampling investigations in the different animal husbandry regions of the country with the objects of (i) evolving a suitable sampling technique for estimating annual milk production, and (ii) collecting reliable data on various practices relating to rearing and feeding of cattle and buffaloes. Such investigations are being undertaken in a typical tract in each region in each year of the Second Plan. The first year's investigation was carried out during 1956-57 in the Punjab State of Northern Region. Similar investigations were undertaken in the portion of Uttar Pradesh State of Eastern Region in 1957-58 and Gujarat and Saurashtra areas of Bombay State of the Southern Region during 1958-59. The fourth year's programme of work has been initiated during 1959-60 in the coastal districts and adjoining areas of Andhra Pradesh. Although it was proposed to cover the coastal districts of Orissa State also during this period but it has not been possible to start the work so far. The plan of work now adopted during the investigation in Andhra Pradesh State is analogous to the one used during the investigation in Bombay State in 1958-59 and reported last year. The field work of the survey in Andhra Pradesh

State is in progress and will terminate by the end of November, 1960. As in the previous years the schedules filled in by the field staff pertaining to the selected households are being received at the I.A.R.S. Headquarters for scrutiny, compilation and statistical analysis.

A preliminary statistical study of the data collected during the survey in Bombay State has given these results. In respect of cows in rural area the estimate of average daily milk yield varied from 1.72 seers in winter season to 2.09 seers in rainy season, the corresponding estimate for the summer season being 1.80 seers. The overall estimate for entire year worked out to 1.86 seers. Similarly, in respect of buffaloes the estimate was 2.91 seers in rainy season, 3.35 seers in winter season and 2.53 seers in summer and overall average was 2.96 seers. In the urban area the estimates were as 2.74 seers in rainy season, 2.27 seers in winter, and 2.46 seers in summer for cows; and 3.38 seers in rainy season, 3.87 seers in winter season, and 3.03 seers in summer for buffaloes. The overall estimate for the entire year was 2.47 seers in respect of cows and 3.46 seers for buffaloes in the urban area. The estimate for the rural and urban areas combined was obtained as 1.91 seers per cow in milk and 3.00 per buffalo in milk.

These estimates were obtained with a fairly high precision. In rural area the percentage sampling error accompanying the estimates for different seasons varied from 4.7 to 7.2 in respect of cows and from 3.7 to 4.7 for buffaloes. Similarly, in urban area the percentage sampling error varied from 4.2 to 5.1 in respect of cows and 2.8 to 8.9 for buffaloes. For the entire year the estimates were obtained with a precision corresponding to a sampling error varying from 2.4 to 3.4 per cent.

SURVEYS

1. SURVEY OF FERTILIZER PRACTICES

The I.C.A.R. has been conducting a series of pilot investigations for study of fertilizer practices in typical areas of the country with the object of collecting factual information on (i) the distribution of manure resources among the different crops grown in the area, and (ii) cultivation practices with regard to (a) type of quantity of manure applied and time and method of its application, and (b) associated cultural practices like improved seeds, irrigation, etc.

During the year 1959-60, the surveys have been initiated in Meerut district of Uttar Pradesh and Alleppey district of Kerala State. The Plan of the surveys is that of stratified multi-State random sampling with tehsils or talukas as strata, a village or kara as a first stage sampling unit, a resident cultivator as a second stage unit and a field as a last stage unit. The method of selecting sampling units at the various States in case of survey in Meerut district consisted of selecting a certain number of villages with probability proportional to the cultivated area and with replacement, eight resident cultivators in each selected village with probability proportional to the number of khasra numbers cultivated by them and two random fields for each of the important crops and one random field for each of the remaining crops out of all these crops grown by the selected cultivator. In case of survey in Alleppey district the method of selecting of karas and cultivators was slightly

different. Both karas and cultivators were selected with equal probability. In all 100 villages in the Meerut district and 75 karas in the Alleppey district were selected for the enquiry.

The field work of the survey was entrusted to full-time field staff consisting of five investigators and one inspector. The administrative control of field work rested with the Department of Agriculture of the respective States, exercised through their Agricultural Officers of the district. The technical guidance is accorded by the Statistical Adviser, I.A.R.S. The filled in data are received at the headquarters of the I.A.R.S. for scrutiny and detailed statistical analysis.

During the same year i.e., 1959-60, detailed statistical analysis has been undertaken with regard to the data collected during the surveys conducted in Ferozepur district (*rabi* season of 1957-58 and *kharif* season of 1958-59) and in Raipur district (1958-59) and certain important results are given below:

Survey in Ferozepore District (rabi of 1957-58 and kharif of 1958-59). About 24 per cent of the total cropped area in the district was manured, 20 per cent was benefited by FYM and compost, four per cent by ammonium sulphate and two per cent by calcium ammonium nitrate. Nearly 31 per cent of the area under wheat was manured, about 24 per cent was benefited by FYM and compost and eight per cent by ammonium sulphate. Nearly three-fourth of the area under American Cotton was manured. About 57 per cent of the area was benefited by FYM and compost, 14 per cent by ammonium sulphate and 12 per cent by calcium ammonium nitrate. The rate of application of ammonium sulphate to American Cotton per acre of area benefited was 114 lb. and to wheat 75 lb. The rate of FYM to wheat and American cotton was estimated at 7.9 tons and 6.8 tons per acre respectively. The total consumption of ammonium sulphate and FYM and compost in the district during the period of the survey was estimated at 4,396 tons and 3,653 thousand tons respectively.

Survey in Raipur District (1958-59). About 36 per cent of the total cropped area in the district received manuring, 32 per cent was benefited by FYM and compost and eight per cent by ammonium sulphate. Paddy, the major crop of the district consumed almost the entire manurial resources. About 56 per cent of the area under paddy was manured, 49 per cent was benefited by FYM and compost and 14 per cent by ammonium sulphate. The rate of application of ammonium sulphate and FYM to paddy were 50 lb. and 2.0 tons per acre respectively. The total consumption of ammonium sulphate and FYM and compost in the district during the period of the survey was estimated at 5,003 tons and 1,771 thousand tons respectively.

2. A PILOT SURVEY FOR THE STUDY OF CULTIVATION PRACTICES AND ESTIMATION OF AREA AND YIELD OF BANANA IN KERALA STATE

The I.C.A.R. has initiated a pilot sample survey in the important taluks growing the banana crop in the districts of Kozhikode, Palaghat and Trichur in Kerala State during 1959-60 with a view to evolving a suitable sampling technique for estimating the area, yield and for collection of data on other characteristics of the crop with a known precision.

The plan of the survey is one of the multi-stage sampling with group of geographically contiguous taluks constituting the strata, villages as the primary units, orchards or survey numbers growing banana or plantains as the secondary units and plots or plantain pits as the ultimate units of sampling. A sample of 90 villages, distributed among 15 strata in proportion to the area under banana and other plantains, has been selected for complete enumeration of the plants and the area under the crop. The number of plots will be recorded separately under bearing and non-bearing categories. For collecting information on the cultivation practices such as varieties grown, frequency of irrigation, manuring, spacing, disease control, indices and protection measures taken for their control etc., a sub-sample of four villages has been selected from each stratum. In each of these four villages, three banana orchards are randomly selected and in each of these orchards two random plots each of size 3 rows $\times$ 5 plants are located for recording information on yield number of fruit in the bunch and their weight. In case of plantains (perennial crop), five survey numbers growing the crop are randomly selected and from each of these three pits are selected at random for collecting yield data. The field work is carried out by 15 investigators who were given training by the officers of the Agriculture Department of the State for conducting the survey.

The field work of the scheme commenced from January, 1960 and is expected to be completed by January, 1961.

3. A PILOT SAMPLE SURVEY FOR STUDY OF CULTIVATION PRACTICES AND ESTIMATION OF AREA AND YIELD OF GUAVA CROP IN ALLAHABAD DISTRICT OF UTTAR PRADESH

A pilot sample survey was initiated during 1959-60 in Allahabad district of Uttar Pradesh with the objects of (i) evolving a suitable sampling technique for collection of data on cultivation practices and yield of guava, (ii) collecting reliable data of known precision on these characters. The plan of the survey is one of stratified multi-stage random sampling with tehsils constituting the strata, a village as a primary unit, an orchard and a cluster of bearing trees being the units, at the second and third stages of sampling. The district has been divided into six strata. A total sample of 60 villages suitably allocated among the different strata were selected. In case of five strata the villages in each stratum were selected with probability proportional to the fresh fruit area of the village and with replacement while in the other stratum, the villages were selected by simple random sampling. A complete enumeration of all the orchards growing guava has been carried out in each of the selected villages for collecting information on area and number of trees under bearing and non-bearing categories and different varieties. Detailed information on distribution of trees according to different age groups and various cultivation practices have been collected from a sample of five orchards selected at random from each of these villages. Data on yield have been collected from a sample of three clusters of four bearing trees each selected at random from each of these orchards.

The field work of the survey commenced in June 1959, and completed by the middle of March, 1960.

4. A PILOT SAMPLE SURVEY FOR STUDY OF CULTIVATION PRACTICES
AND ESTIMATION OF AREA AND YIELD OF MANGO CROP IN
SAHARANPUR DISTRICT OF UTTAR PRADESH

A pilot sample survey has been initiated during 1959-60 in Saharanpur district of Uttar Pradesh with the object of (1) evolving suitable sampling technique for collection of data on cultivation practices and yield of mango, and (2) collection of reliable data of known precision on these characters. The plan of the survey was one of stratified multi-stage random sampling with tehsils constituting the strata, a village as a primary unit, an orchard and a cluster of bearing trees being the units at the second and third stages of sampling. The district has been divided into four strata. A total sample of 50 villages allocated among the different strata in proportion to the area under orchards in each stratum, were selected. Within each stratum the villages were selected with probability proportional to the orchard area of the village with replacement. A complete enumeration of all the orchards growing mango was carried out in each of the selected villages for collecting information on area and number of trees under bearing and non-bearing categories and different varieties. Detailed information on distribution of trees according to different age groups etc., and also data on various cultivation practices were collected from a sample of five orchards selected at random in each village. Data on yield are collected from a sample of three clusters of four fruit bearing trees each selected at random from each of these orchards.

The field work of the survey commenced in March, 1959 was completed by August, 1959. The detailed statistical analysis is in progress.

5. A PILOT SAMPLE SURVEY FOR ESTIMATION OF AREA AND YIELD
AND STUDY OF CULTIVATION PRACTICES OF CASHEWNUC CROP
IN KERALA AND MYSORE STATES

Under the Second Five Year Plan, the Indian Council of Agricultural Research has initiated a pilot scheme in Kerala and Mysore States during 1959-60 with the object of (i) evolving suitable sampling technique for collection of data on cultivation practices and field of cashewnut crop and (ii) collecting reliable data of known precision on these characters.

The plan of these investigations is one of stratified multi-stage random sampling in which the important taluks or group of taluks formed the strata, a village is the unit at the first stage of the sampling, and an orchard, a cluster of bearing trees are the units at the subsequent stages of sampling. The plan of sampling adopted in both the States is more or less the same except for slight variations. In Kerala State a total of 108 census villages suitably allocated among the strata, have been selected. Of this, half the number of villages are those selected in clusters of three villages each while the remaining half have been selected at random. In case of Mysore State, however, an additional sample of 42 villages from among those villages not reporting the crop have been selected at random. In each of the sample of villages in both Kerala and Mysore States, information on the number of cashewnut trees and area under the crop are collected. Data on cultivation practices and yield of the crop are collected in all the selected villages of Mysore State but in

Kerala State this item of work is confined to those villages selected in clusters. In each of these villages two orchards are selected at random for collection of data on the various cultivation practices of crop and for yield study. In each of the selected orchards two clusters of three adjacent bearing trees are selected at random and yield of cashewnut crop is recorded separately for each tree and for each harvest in the crop season. For the purpose of determining the yield of stray trees, a further sample of two clusters of three stray trees each are selected at random from each of the selected villages and yield data collected for each of these trees.

The field work of the investigation commenced in October, 1959 in Mysore State and January, 1960 in Kerala and it is expected to be completed by September-October, 1960. The investigation is operated under the administrative control of the respective State Governments and the necessary technical guidance in the conduct of the survey is given by the Statistical Adviser, Institute of Agricultural Research Statistics.

The field and supervisory staff consisted of 20 enumerators and four Junior Statistical Assistants in case of Mysore State and nine investigators in Kerala State.

6. A PILOT SAMPLE SURVEY FOR STUDY OF CULTIVATION PRACTICES AND ESTIMATION OF AREA AND YIELD OF PEPPER CROP IN KERALA STATE.

It had been reported last year that a pilot sample survey was carried out during 1958-59 in the pepper growing areas transferred from the erstwhile Madras State to Kerala State. A detailed statistical analysis of the data was undertaken at the headquarters of the Institute of Agricultural Research Statistics during the year 1959-60 and the certain important results are given below:

The total number of bearing and non-bearing standards were estimated at 15.8 and 6.2 millions with percentage sampling errors of 2.5 and 3.6 respectively. The estimate of average green yield per bearing standard was 40.6 oz. with 6.4 per cent sampling error. The ratio of dry black pepper to green produce (without spikes) was estimated at 0.34 with 1.8 per cent sampling error. The total dry pepper production in the area was of the order of 6,070 tons. This was estimated with 6.9 per cent sampling error.

It was observed that about 90 per cent of the standards were below the age of 20 years and about 36 per cent below four years of age. The most popular type of support was found to be Murukku which alone accounted for 71 per cent of the total. Balankotta, Kalluvally, Karankota and Nandamvally varieties of pepper vines together accounted for 90 per cent of the total number of standards. Manuring the crop was not commonly practised even though the data available showed good response of the crop to manuring. It was observed that only 12 per cent of the plots received manure. About 80 per cent of the plots received one or two diggings. Soil conservation measures like terracing, contour bunding and growing of cover crops are being adopted in 88 per cent of the plots whereas other cultivation practices like weeding etc., is being followed in only ten per cent of the plots.

7. STUDY OF MILK YIELD, BREEDS, FEEDING AND MANAGEMENT PRACTICES OF CATTLE AND BUFFALOES, 1959-60

The Indian Council of Agricultural Research has been undertaking since 1956-57 a series of pilot sampling investigations in the different animal husbandry regions of the country with the objects of (1) evolving a suitable sampling technique for estimating annual milk production, and (2) collecting reliable data on various practices relating to rearing and feeding of cattle and buffaloes. Such investigations are undertaken in a typical tract in each region in each year of the Second Plan. The first year's investigation was carried out during 1956-57 in the Punjab State of Northern Region. Similar investigations were undertaken in the portion of Uttar Pradesh State of Eastern Region 1957-58 and Gujarat and Saurashtra areas of Bombay State of the Southern Region during 1958-59. The fourth year's progress work has been initiated during 1959-60 in the coastal districts and adjoining areas of Andhra Pradesh and Orissa States. The plan of work now adopted during the investigation is analogous to the one used during the investigation in Bombay State 1958-59 and reported last year.

A preliminary statistical study of the data collected during the survey in Bombay State has given the following results. In respect of cows in rural area, average daily milk yield per animal in milk varied from 1.72 seers in winter season to 2.09 seers in rainy season, the corresponding estimate for the summer season being 1.80 seers. The overall estimate for the entire year worked out to 1.86 seers. Similarly, in respect of buffaloes the estimate was 2.91 seers in rainy season, 3.35 seers in winter season and 2.53 seers in summer and overall average was 2.96 seers. In the urban area the estimates were as 2.74 seers in rainy season, 2.27 seers in winter and 2.46 seers in summer for cows; and 3.38 seers in rainy season, 3.87 seers in winter season, and 3.03 seers in summer for buffaloes. The overall estimate for the entire year was thus 2.47 seers in respect of cows and 3.46 seers for buffaloes in the urban area. The estimate of average daily milk yield for the rural and urban areas combined was obtained as 1.91 seers for cow in milk and 3.00 for buffalo in milk.

8. SCHEME FOR STUDY OF POULTRY PRACTICES AND PRODUCTION IN ANDHRA PRADESH

A scheme for evolving a suitable sampling technique for collection of data on poultry production and practices in three important regions of the country has been approved by the Planning Commission and included in the Second Five Year Plan. The first year's programme of work has been initiated during 1959-60 in ten districts of importance for poultry keeping of Andhra Pradesh. The field work is spread over entire 12 months' period of the year.

According to the plan about 15 thousand households will be contacted for collecting data on egg production and other details.

The field work commenced during November, 1959 and is expected to be completed by November, 1960. The data collected during the survey are being received at the Headquarter of Institute of Agricultural Research Statistics for scrutiny and detailed statistical analysis.

9. SCHEME FOR STUDY OF FEEDING AND REARING PRACTICES
OF SHEEP AND YIELD OF WOOL, JORIA REGION, BOMBAY STATE

The object of the scheme is to develop a suitable sampling technique for estimating wool production and to collect reliable data on breeds and rearing, feeding and management practices of sheep.

The design of the survey is one of multi-stage stratified sampling. All the 115 taluks of the region were combined into 60 groups of taluk on the basis of geographical contiguity and sheep population as reported in the 1956 Livestock Census. These 60 groups, were formed into three size strata namely those having less than 20,000 sheep, 20,000 to 35,000 sheep and over. For the purpose of survey work, 18 groups of taluk were selected, the allocation of the number of groups to the different strata being in proportion to the total sheep numbers within each stratum.

The groups from each stratum were selected at random with equal probability without replacement. One enumerator has been kept in charge of the field work in each selected group. Within each group the work will be confined to 12 clusters of three villages each, selected at random.

The programme of work may be classified as the work in the shearing season and that in the off-season i.e., the period of the year when wool shearing is not done. It may be mentioned that the shearing wool in the Joria region is done twice a year, namely September-October and February-March.

During the off-season the work in each cluster of villages will last for a period of six days and one day will be taken for travel from one cluster to another. The field work consists of contacting all the flocks in the periphery of the selected village or town and recording the information on the number of flocks, stationary as well as migratory, sheep numbers in each flock, breeds, feeding and grazing practices, treatment against diseases, disposal of sheep, wool yield at last shearing, particulars of acquired sheep and other general information such as penning facilities, sheep folding, equipment used for shearing, labour employed, etc.

During the shearing season the work will be confined to only four clusters of villages. The work during shearing season consists of selecting two rams, two lambs and two ewes from each flock in the village and of recording their individual fleece weight, body weight and taking a sample of wool from the mid-side region of each of these sheep for the study of wool quality. In addition flock-wise information on the total yield of wool, labour employed for shearing, charges paid, equipment used, the mode of disposal of wool etc., will also be collected.

The field work of the survey commenced from July, 1959 and will last for a period of one year. The field staff consists of one field officer, three inspectors, six supervisors and eighteen enumerators. The returns received are being scrutinised and tabulation of data undertaken.

10. SCHEME FOR ASSESSING COST OF CULTIVATION OF COTTON AND ROTATION
CROPS IN PRINCIPAL COTTON AND OIL-SEEDS PRODUCING REGIONS IN INDIA

The scheme is being implemented under the joint auspices of the Indian Central Cotton Committee, Indian Oilseeds Committee and Indian Council of

Agricultural Research and has been initiated during 1959-60. The basic objective of the scheme is to estimate the cost of cultivation of cotton and the principal food and oilseed crops grown in rotation with cotton in principal regions producing cotton on commercially important varieties. The survey has been planned to estimate the cost with a known degree of precision both in terms of physical units such as human and bullock labour and materials such as seeds, manures, etc., required in the cultivation of these crops as well as in terms of the money values of these items of cost. The scheme will be in operation for three crop seasons so as to take into account seasonal variations of physical inputs as well as outputs and thus arrive at suitable estimates of the various components of cost of production. Once such estimates are obtained, it will be feasible not only to calculate the cost of production for the years under study but also to work out indices of cost of cultivation of these crops in future years with the help of appropriate data on wages and prices prevalent during the particular years.

The four zones covered by the survey are as under:

- (1) Punjab zone consisting of districts of Ludhiana, Bhatinda, Sangrur and Hissar.
- (2) Gujerat zone consisting of districts of Mehsana, Sabarkantha, Ahmedabad, Kaira, Baroda, Broach and Surat.
- (3) Black cotton soil zone consisting of districts of Akola, Buldana, Amravati, Yeotmal, East Khandesh and Aurangabad, and
- (4) *Rabi* cotton zone of Karnatak consisting of districts of Raichur, Bijapur and Dharwar.

In each of these zones the districts were adopted as strata and 40 villages, allocated among the strata proportional to the area under cotton and oilseeds, were selected. Within each stratum the villages were selected with probability proportional to the acreage under cotton and oilseeds in a village. The total number of holdings in the 40 villages were divided into three size classes and two to three holdings were selected at random from each class in each village.

11. PILOT SCHEME FOR "DEVELOPING AND MAINTAINING RESEARCH PROJECT FILES" (Hqrs).

The joint Indo-American Team on Agricultural Research and Education *inter alia* recommended that Indian Council of Agricultural Research should maintain a complete file of research projects relating to agriculture and animal husbandry, supported by the Council, Commodity Committees, Central and State Government and other research organizations.

The Council accepted this recommendation and a pilot scheme covering the research projects supported by Indian Council of Agricultural Research was sanctioned so as to develop a suitable system of readily available reference on their technical progress and financial and personnel status.

The object of the scheme is to help effective implementation of different research projects by keeping in close touch with their progress and to ensure that the funds of the Council are utilized for the intended purposes according to the technical programme laid down and that the various difficulties that tend to arise are resolved promptly. The file will help in the preparation of 'Subject Matter Files' which

reflect in advance thinking of furtherance of research on the subject. After the completion of a research scheme, the file relating to that scheme, complete in all respects, shall be kept in Indian Council of Agricultural Research Library for future reference.

The layout and the format of the research file have been finalized. A project file on a scheme mainly consists of organizational and technical details together with references of connected work. Under organizational details information in respect of objectives, location, date of commencement, duration, financial position, personnel status, equipment etc., is included in the file. Besides, technical details in respect of technical programme, item-wise progress of work, comments on the annual progress reports, results of practical or academic value achieved, evaluation note and papers published as a result of the researches done form part of the file. Under reference, researches done on connected and similar work and an index of all the files on the scheme is included.

Projects files for 40 schemes have been started and 20 of them are now up-to-date and are ready for reference for the use of the Council.

Mechanical Tabulation of Data. The formulation and implementation of Second Five Year Plan stimulated a phenomenal demand for more reliable, precise and timely statistics. To meet this deeply-felt need, the Institute recently acquired through the T.C.M. a Mechanical Tabulation Set and organized a Mechanical Tabulation Unit to execute work on this set.

Since the installation of this equipment, data relating to a number of schemes has been tabulated on these machines. The equipment helped both in the speedy and comprehensive tabulation of data collected in those schemes. It thus helped to increase the statistical output of the Institute and also in doing fuller justice to the ancillary information collected under the various projects. Mention may be made of the following schemes whose data has been handled on the machines in the last few months:

- (1) Milk Yield Survey, Uttar Pradesh.
- (2) Fertilizer Demonstration Trials.
- (3) Cost of Milk Production, Madras State.
- (4) Study of Feeding and Rearing Practices of sheep and Yield of Wool, Joria Region.

To strengthen the Machine Tabulation Unit still further an Electronic Multiplying Punch and some punching equipment has been ordered. The installation of the additional equipment would be a valuable addition to the computational facilities of the Institute, and help increase the statistical output still further.

Training. Two types of courses are being conducted by the Institute. The first type of course is meant for research workers in agricultural and animal husbandry sciences whose primary interest is not statistics but for whom statistical mathematics is an important tool to carry out research. The second type of course is meant for those whose primary interest is the statistical field itself and who have had some post-graduate education in statistics and wish to qualify as professional statisticians in agriculture and animal husbandry and allied sciences. Two courses called the Junior Certificate Course and Senior Certificate Course are conducted for the benefit of research workers belonging to the first group mentioned above.

The Junior Certificate Course extends over a period of five months while the Senior Certificate Course runs for period of one year.

Two courses of training are arranged for students who wish to specialise in agricultural statistics. They are the Professional Statistician's Certificate Course and the Diploma Course of one year and two years' duration respectively. As a result of the co-ordination of the activities of this Institute in the sphere of training of professional statisticians with those of the Indian Statistical Institute, Calcutta, a joint selection board has been set up for admission to the Professional Statisticians' Course of Indian Statistical Institute and Institute of Agricultural Research Statistics. Under this arrangement students completing successfully the first year of the Professional Statisticians' training at the Indian Statistical Institute and desiring to specialize in agricultural statistics are given first preference for admission to the Professional Statisticians' Course of the Institute of Agricultural Research Statistics. The successful trainees at the end of one year are awarded Professional Statisticians' Certificate (Agriculture) similar to the one given by the Indian Statistical Institute at the end of the second year of their course. A few showing special aptitude for research are allowed to work on a thesis on some research topic for the award of diploma in agricultural statistics, after one year.

The first session of training under the new arrangement commenced in August, 1959 and nine candidates were selected for admission to the Professional Statistician's Certificate Course. Ten students were admitted to the Junior Certificate Course and fifteen to the Senior Certificate Course.

All the twenty-four candidates who appeared in the Senior Certificate Course examination held in June-July, 1959, were declared successful.

Five students submitted their thesis for the award of Diploma during 1959-60.

Four persons are receiving Indian Council of Agricultural Research fellowships for research in statistics. They are working on 'Tolerance Limits in Distribution Theory', 'Some Models in Stockastic Process', 'Fisher Beheren Problem' and 'Successive Sampling'.

Two foreign students are undergoing specialized training at the Institute.

The students of the Professional Statisticians' Certificate Course and the Senior Certificate Course went on an educational tour for the period of a fortnight and visited various places of interest of agricultural and animal husbandry research.

The Institute is continuing to give the prescribed courses in Statistics to the students of the Post-graduate School, Indian Agricultural Research Institute. During the year under report, four courses were conducted and 61 students of the Ph.D. course and 118 students of the M.Sc. Course attended the above courses.

An international training centre in fisheries statistics jointly organized by the F.A.O. and the Government of India (Indian Council of Agricultural Research) in co-ordination with the Indo-Pacific Fishery Council was conducted at Bombay by the Institute. Representatives from Indonesia, Japan, Philippines, Thailand, Malaya, Viet-nam and India took part in this training. This course lasted for a period of eleven weeks.

AGRICULTURAL ECONOMICS

As in the previous years, the Universities and Research Institutes continued schemes of Agricultural Economics financed by the Indian Council of Agricultural Research. A brief summary of them is given below:

1. STUDY OF INTENSIVE AGRICULTURAL PRACTICES ON THE SMALL HOLDINGS

The scheme has been undertaken by the Calcutta University with the object of determining an economic holding size under intensive cultivation practices, which may provide full employment to common cultivators. The scheme has been taken for a period of five years with effect from September, 1956. According to the plan, nine cultivators' holdings have been selected for collection of data on input and output of agricultural production. Side by side similar data are being collected from three artificial holdings taken on the experimental farm for comparison purposes. Progress report on the work of third year (July, 1958 to July, 1959) was available. It is observed that the variations in returns are comparatively greater than the variations in inputs. Among the nine cultivators' holdings, cost of cultivation varies from Rs. 292/- to Rs. 530/-, the average being Rs. 407/-. The corresponding average cost per acre in the State Farm is Rs. 404/-. Incomes for holdings on the nine cultivators range from Rs. 303/- to Rs. 506/- per acre, the average being Rs. 423/-. The corresponding income per acre in the State Farm is Rs 32/- only.

2. STUDY OF MECHANISED FARMING

With the object of studying the investment, output under various degrees of mechanisation of farm, crop rotations, and comparing the rate of investment, profits and land use of mechanised farm, the Council sanctioned a scheme to be undertaken by the Banaras Hindu University in 1959, at a cost of Rs. 29,000/-. According to the plan of work data on various items of input and output will be collected from a number of randomly selected farms in Meerut District and in Tarai tract of Nanital District.

3. ENQUIRY INTO THE FACTORS INFLUENCING CROPPING PATTERNS
ON INDIVIDUAL HOLDINGS

A co-ordinated scheme with the object of studying the factors influencing the cropping patterns on individual farmer's holdings was sanctioned by the Council for six important Regional Centres, namely (1) Government Agriculture College, Ludhiana, (2) B. R. College, Agra, (3) Directorate of Agriculture, Bihar, Patna, (4) Government Agriculture College, Bapatana, (5) Utkal Krishi Mahavidyala, Bhubaneswar, and (6) Institute of Agriculture, Anand. The work at the Centre, Institute of Agriculture, Anand was dropped by the Direction Committee of the Agriculture Economics Committee as the Institute of Agriculture, Anand expressed inability to undertake this work. Of the remaining five centres, field work could start during the year under report only at the Bhubaneswar centre. The first round of the survey namely, collection of data on *rabi* crops has been completed and the work of collection of data for the other crops is in progress.

On the recommendations of the Agricultural Economics Committee and the Advisory Board, the Governing Body of the Council at its meeting held in December, 1959, sanctioned the following six schemes for studying various problems of agricultural economics.

(1) *Enquiry into the Facts of Lift Irrigation—Usmania University.* The object of the scheme is to assess the benefits (total and net, direct and indirect) of lift irrigation accruing to farmers through a comparison of economics and efficiency of farm business on cultivators' holdings with and without irrigation.

(2) *Enquiry into Economics in Coimbatore District—Madras State.* The object of the scheme is to study the economics of irrigation by various types of lifts and their influence on the prosperity of the agriculturists.

(3) *Operational Research for Studying the Extent to which Improved Agricultural Practices are being Adopted and their Economics—Madras Government.* The object of the scheme is to make a comprehensive enquiry and to study how far the improvements resulting from the research carried on in various fields have been adopted, and also to study the comparative economics of old and new methods.

(4) *Conduct of Pilot Surveys for Evaluation of various Improved Agricultural Practices in U.P.—U.P. Government.* The object of the scheme is to find out the extent to which improved agricultural practices have gone into the fields and their economic implications.

(5) *Studies in the Behaviour of Consumption and Marketing, Gokhle Institute of Politics—Poona.* The object of the scheme is to study the time pattern and the quantum of sales and purchases of different commodities as well as their consumption over two years by the peasants from Akola and Amravti districts of Maharashtra State.

(6) *Sample Survey for Determining Facts of Mechanisation of Fishing Track—Maharashtra State.* The object of the scheme is to obtain detailed estimates for power and non-power of fishing unit in respect of the items, (i) trips and fishing efforts, (ii) fish catches, (iii) composition of costs, (iv) composition of revenues, (v) net income, and (vi) indebtedness.

Agricultural and Veterinary Education

Higher Agricultural and Veterinary Education. The large expansion of the facilities for agricultural education during the Second Five Year Plan was reflected in the size of the grants made by the Central Government during the past four years in order to assist the State Governments in the establishment of new colleges or in strengthening the existing institutions. The total financial assistance during the past four years amounted to Rs. 3,28,65,760 as grant and Rs. 1,10,13,158 as loan for the above purposes. Consequent to these aids, the number of admissions in agricultural colleges for degree courses increased from 1,254 in 1953-54 to 4,298 in 1959-60, while in veterinary colleges the corresponding increase was from 615 to 1,362. The increase in admission strength in agricultural colleges exceeded 1,000 during the year under report while the increase in admission strength was only 69 in veterinary colleges. The target of 6,500 agricultural graduates and 3,000 veterinary graduates for the Second Five Year Plan is likely to be achieved fully as a result of the above measures.

Agricultural University. For the first time in the country an Agricultural University has been decided to be established more or less on the principles of the Land Grant Universities in U.S.A. The Government of India have agreed to provide financial assistance to the extent of Rs. 167·5 lakhs as grant and Rs. 73·5 lakhs as loan to the Government of Uttar Pradesh for the establishment of such a University in Phoolbagh. This University is expected to start functioning from June, 1960, and will have a college of agriculture, a college of veterinary medicine and a college of engineering and technology as its constituent colleges. The last one of the colleges is, however, expected to be established only in 1961.

With complete autonomy as enjoyed by other Universities in India, this University at Phoolbagh will have the freedom to shape its own curriculum to suit to the changing needs of agriculture in this country without being inhibited by the traditions of the formal type of universities.

Post-graduate Education. Under a scheme to provide financial assistance to the States, post-graduate courses had been started at the Agricultural College, Coimbatore, and the Veterinary Colleges, Mathura and Madras during 1958. The post-graduate courses at the Government Agricultural College, Ludhiana, were started during 1959, while similar courses at the West Bengal Agricultural College and at the Veterinary Colleges at Patna and Bombay are likely to be started from July, 1960.

Refresher Courses for Teachers. During the year under review, refresher courses were held in the subjects of plant breeding, agricultural engineering and soil

science for the benefit of teachers in agricultural colleges. The courses proved very popular and were attended by teachers of agricultural colleges from all over the country. The course in plant breeding was attended by 23 teachers while those in agricultural engineering and soil science were attended by 23 and 46 respectively.

A refresher course was also organized at the I.C.A.R. library in New Delhi to impart refresher training to the librarians of the agricultural and veterinary colleges. This was attended by 16 librarians.

Inter-institutional Arrangements with American Universities. Under this agreement a total number of 25 U.S. technicians were in position during the year under report at 18 agricultural and 5 veterinary colleges. The number of participants deputed for higher training to U.S.A. was 66 during the year under report. The value of equipment and books supplied to the participating Indian institutions under the programme during the year under report is about Rs. 27 lakhs. The total value of the laboratory equipment and books supplied to the Indian institutions since the inception of the programme upto the end of March, 1960, amounts to about Rs. 73.5 lakhs.

Under a separate agreement, the T.C.M. have agreed to provide assistance in the form of laboratory equipment and books, etc. to the extent of \$3,00,000 for the proposed Agricultural University at Rudrapur in Uttar Pradesh.

Third Seminar on Teaching Methods. The Third Seminar on teaching methods in agricultural and veterinary science was held at Bombay on the 15th March, 1960. This was attended by 75 principals and representatives of teachers of the various colleges in agricultural and veterinary sciences in India as well as eight members of the American Land Grant Colleges stationed in India. The Seminar was mainly devoted to the consideration of matters relating to post-graduate education in India. Among the many recommendations made by this Seminar were the setting up of a mechanism to lay down standards and for inspection of the colleges in order to determine which of the institutions could be developed at the post-graduate stage, the provision of supporting courses, enhancement of scholarships, and fellowships and measures required for a careful selection of guides for post-graduate trainees.

Fourth Session of I.C.A.E. The Fourth Session of the Indian Council of Agricultural Education was held at Aarey Milk Colony, Bombay, from 17th March, 1960. It was attended by three Vice-Chancellors, representatives of the agricultural, veterinary and home science colleges as well as officers of Indian Council of Agricultural Research and Technical Co-operation Mission technicians. As a body responsible for co-ordination of agricultural education activity in the country, the Council was concerned with the growing deterioration in the standards of education consequent to (1) shortage of trained teachers, (2) lack of adequate facilities by way of laboratory and field equipment and (3) diversity of patterns in regard to eligibility standards for admission. Some of the more important recommendations made by the Council for improving the standards of teaching in agricultural and veterinary colleges were as follows:

(i) In order to maintain a uniform standard of education in agricultural and veterinary subjects at both under-graduate and post-graduate levels, an

accreditation body should be set up which should visit agricultural and veterinary colleges once in three years to evaluate the standards of education and teaching facilities available at the Institution.

(ii) In order to ensure proper repair and maintenance of the various highly specialized items of laboratory equipment, a centre should be established at the Indian Agricultural Research Institute, New Delhi, for imparting training in repair and maintenance of equipment to the instrument technicians employed in the various agricultural and veterinary colleges.

(iii) Refresher courses which should be strictly of a practical nature relating to the needs of the farmers should be started in all agricultural and veterinary colleges and agricultural schools for imparting training in improved methods of agriculture to the sons and daughters of farmers.

(iv) To cope with the present critical shortage of trained teachers, teachers training courses should be started for the benefit of agricultural and veterinary graduates desirous of taking teaching as their profession.

(v) Staff colleges should be established for imparting in-service training to the officers of the agricultural and veterinary departments.

(vi) The number of scholarships and fellowships for students in agricultural and veterinary colleges should be increased.

(vii) A separate pool on the lines of the pool organized by the Council of Scientific and Industrial Research should be started to provide an interim relief to highly trained scientists in the field of agricultural and veterinary sciences for such time as they are able to find suitable employment.

Second Joint Indo-American Team. An event of considerable importance during the year is the decision of the Government of India to set up the Second Joint Indo-American Team to assist in the formulation of proposals for the Third Five Year Plan based on an evaluation of the progress of work pertaining to agricultural education, research and extension during the past five years, and incidentally to review the sisterhood arrangements concluded in 1955 with the five Land Grant Universities in U.S.A. under the Indo-U.S. Technical Co-operation Programme with a view to find out how these have helped and whether the arrangements could be continued during the Third Five Year Plan. This team was constituted in October, 1959. The report of the team was in the process of finalization.

Agricultural Extension Advisory Committee. The Agricultural Extension Advisory Committee was set up in August, 1954 on the suggestion of the Community Projects Administration to ensure that the recommendations of the Council as well as those of the State Departments of Agriculture regarding the Extension work in the different parts of the country were given due consideration in the conduct of agricultural and animal husbandry development work in the project areas. To achieve this objective, this standing Committee prepares self-contained notes based on the latest results of researches obtained by the State Governments, Central Commodity Committees and Central Research Institutes and containing detailed information on all aspects of cultivation of agricultural crops, for all the State/Territories (within them region-wise). The Committee has so far prepared 57 regional notes on rice, 44 on wheat, and 48 on sugarcane for different agro-climatic conditions in the States and these have been passed on to the Ministry of Community Development and

Co-operation for transmission to the extension workers. Similar notes are being finalized also on cotton and millets for the different States.

Such notes for different States have also been prepared on different livestock species, viz., cattle and buffaloes—59, and sheep and Goats—18 and have been released to the Community Development and Co-operation Ministry for similar action. It has been lately decided that the notes already issued should be revised in the light of the reaction of the State Governments, etc.

With a view to maintain proper collaboration with the Extension Directorate, Dr. T. R. Mehta, Director of Farm Advisory Unit, of that Directorate has been appointed as Secretary of this Committee.

Scheme for the Award of the Rafi Ahmed Kidwai Memorial Prizes for Agricultural Research. The Governing Body, at its last meeting held in December, 1959, decided that the Rafi Ahmed Kidwai Memorial Prizes for Agricultural Research, instituted by the Council for creating an incentive for research workers and for recognizing outstanding research work done by them in the field of agriculture, animal husbandry and allied sciences, carrying 11 prizes of the value of Rs. 5,000 each, should be awarded on a biennial basis i.e., once in two years instead of on annual basis because really outstanding results were not likely to be achieved every year. Accordingly, applications from research workers in India, on the basis of results of outstanding researches achieved by them during the calendar years 1958 and 1959, have been invited for award of prizes during 1960.

Scheme for the Utilization of the Services of Retired Scientists. In order that the talent and experience of retired scientists of established repute is not wasted after retirement for lack of opportunities to pursue work in their fields of specialization, the Indian Council of Agricultural Research has sanctioned a scheme for the utilization of the services of retired scientists in the field of agriculture, animal husbandry and allied sciences. Under the scheme, suitable financial assistance will be provided by the Council to retired scientists of established repute to pursue their researches. The scheme has been implemented with effect from the 1st April, 1960.

Publications and Publicity

THE publication work of the Council continued to expand during the year under review. In addition to the seven journals which were being published in the past, viz., Indian Farming, Indian Horticulture, Kheti, Rice News Teller, Indian Journal of Agricultural Science, Indian Journal of Veterinary Science and Animal Husbandry and Statistical News Letter, two new journals were started. These were, (i) Indian Journal of Agricultural and Veterinary Education, which is a half-yearly publication devoted to Agricultural education in India; (ii) The Indian Potato Journal, which is issued half-yearly and contains scientific articles on the problems of potato cultivation. The issue of Horticultural Abstracts as a separate publication was discontinued, and it was decided to incorporate the material in Indian Horticulture. Further, in pursuance of the recommendations of the Conference on Genetics and Breeding, a scheme was sanctioned for the publication of an annual journal on plant breeding and genetics. This journal will contain brief reports of the research work being done on breeding and genetics in the field of agriculture and animal husbandry in India.

Besides the publication of journals, the Council prepared a comprehensive three-year programme for the production of about 90 scientific monographs and books (including text books). In addition, a large number of bulletins, pamphlets and reports were also published. A scheme was also initiated for producing books, pamphlets and bulletins in Hindi and four languages, viz., Tamil, Telugu, Kannada and Punjabi.

Scientific Monographs. The following scientific monographs were printed during the year under report:

- (1) Zygnemaceae by M. S. Randhawa
- (2) Cyanophyta by T. V. Desikachary
- (3) Cultural trials and practices of Rice in India by M. Subbiah Pillai.
- (4) Chemotherapy of animal trypanosomiasis by S. K. Sen.

Books. The following books were published during the year:

- (1) Poultry Keeping in India
- (2) Lessons in Forestry
- (3) Home Science
- (4) Students Guide to Dissection of the Bovine
- (5) Embalming by Intravascular Injection.

Reports, Bulletins and Pamphlets. The reports, bulletins and pamphlets published during the year include the following:

- (1) Fertilizer trials on paddy

- (2) Fertilizer trials on wheat
- (3) Bovine stars of India
- (4) South India cardamoms and their agricultural value
- (5) Fungi of Delhi
- (6) Tree planting along railway lines
- (7) Properties of colloid soil constituents by S. P. Raychaudhuri
- (8) Spirochaetosis in poultry incidence and its control by S. B. V. Rao
- (9) Johnne's disease in cattle, sheep and goats by J. M. Lal
- (10) Adhesives from proteins of *Crotalaria juncea* by D. N. Narayanamurti and P. N. Grover
- (11) Artificial fertilizers by S. P. Raychaudhuri and J. J. Chandani
- (12) Blast and foot rot diseases of rice in Madras State by C. S. Krishnaswamy, C. V. Govindaswamy and N. R. Adyanthaya
- (13) Role of earthworms in argiculture by J. V. Bhat and S. R. Khambata
- (14) Shifting cultivation practices in India by K. C. Kaith
- (15) Swine husbandry and piggery products by R. L. Kaura
- (16) The menace of heart-rot fungi to forest trees, their causes and effects by K. Bagchee; and
- (17) Urea as a fertilizer by P. C. Raheja and K. S. Yawalkar.

Rinderpest Eradication Publicity. One lakh posters in eight regional languages were produced and distributed to State Governments as part of the campaign against rinderpest which has been launched on a country-wide scale.

Symposium on Algology. An International Symposium on Algology was organised under the joint auspices of the Council and the UNESCO as a measure to promote exchange of information and ideas. Eminent algologists participated in the Symposium. It was decided to publish a comprehensive book on different aspects of algology discussed in the Symposium. The book is under print now.

World Agriculture Fair. In collaboration with the Commodity Committees, the Council participated in the World Agriculture Fair held in Delhi. The pavilion put up by the Council was among the outstanding exhibits at the Fair and attracted wide notice.

Subsidies to Scientific Journals. To help scientific societies in the publication of journals devoted to agricultural and allied subjects, the Council continued to provide necessary financial assistance. The subsidies were enhanced from one-third to one-half of the cost of production in view of the rising cost of printing and paper.

Sale and Distribution of Publications. During the year under review a total revenue of Rs. 6,08,816 was earned from the sale of publications and Rs. 65,473 from advertisements published in the Council's journals. Over five lakh copies of different publications were supplied to C.D. and N.E.S. Blocks for the use of Village Level Workers. In addition, a large number of copies were distributed free or on exchange basis.

Agricultural Instructional Films. The Indian Council of Agricultural Research continued to produce agricultural instructional films on various subjects for the benefit of farmers and agricultural students, through the Films Division of the Ministry of Information and Broadcasting. Different language versions of these films are being produced for supply to the State Governments and other

institutions for wider circulation. The following films were completed during the period under review:

1. Groundnut.
2. Pond Culture.
3. Regulated Markets.

Library

THE following is the report on the work done in the Library during the year, April, 1959 to March 1960. Good progress has been made in the implementation of the recommendations made in Dr. Shaw's Report for the Indian Council of Agricultural Research Library. Consequently, there has been considerable increase in the activities and volume of work in the Library. The progress of the work of the library is presented below:

1. **Acquisition Section.** There was an addition of 1,717 publications as against 1,231 in the previous year. Five library lists of additions were prepared and circulated. Current issues of periodicals numbering about 13,239 and newspapers numbering 5,820 were received and registered. About 5,146 reports and bulletins were received during the year.

2. **Re-organization and Development.** Consequent on the implementation of the recommendations of Dr. Shaw's Report, following new items of work and services were initiated:

(a) *ICAR Book Insurance Scheme.* This scheme was initiated to assist the libraries in agricultural and veterinary colleges to implement open access under the protection of the above scheme by following all the conditions laid down by the scheme and becoming members of the scheme. The following libraries were enrolled as members during the year under report:

- (1) Rajasthan College of Agriculture Library, Udaipur.
- (2) S. K. N. Agricultural College Library, Jobner.
- (3) Madras Veterinary College Library, Vepery, Madras.
- (4) M. P. College of Veterinary Science and Animal Husbandry Library, Mhow Cantt. (M.P.).

Other college libraries have been advised to avail themselves of the facilities of this scheme and implement open access. Some of the college libraries have already made sufficient progress for implementing the conditions required and are likely to be enrolled as members of this scheme during the year 1960-61.

(b) *Book Selection Bibliographic Service.* To assist the college librarians with a ready tool for book selection, special book selection bibliographies are being compiled on specific subjects in agriculture and animal husbandry. These are distributed to the librarians of all the agricultural, veterinary college libraries. During the year, ten bibliographies covering a total of 520 entries were prepared and distributed. This service has been acclaimed as a very useful service by the Principals of the agricultural and veterinary colleges.

- (c) *Documentation Service.* To provide intensive bibliographical service at the level of articles in periodicals, Documentation service was started by the Council. Documentation lists are being distributed to colleges, research institutes, stations and farms, numbering about 600. During the year a total of 813 articles were indexed and processed for the above service.
- (d) *Advisory Circular Letters.* The Council's library started service of advisory circular letters to cover all aspects of library work technique and services. During the year, four circular letters were issued. These were on open access and how to implement the same, advantages of open access, some objections to open access and the modern trend, policy and principles that should guide book selection in college libraries. These advisory letters have been acclaimed as a very useful service to colleges by some of the T.C.M. experts working in the different States.
- (e) *Inspection and Advisory Service.* On specific requests, the Council's Librarian visited the agricultural and veterinary college libraries, at Vellayani, Parbhani, Mathura, Trichur and Agra and advised them on the layout furniture, equipment, implementing open access, organization, classification, cataloguing and other routine as well as technical problems.
- (f) *Refresher Course in Library Science.* The Librarian organised and conducted a refresher course for trained college librarians. This course was for a fortnight and 16 college librarians from all over the country attended the training course. Lectures, discussions, demonstrations, actual working and guided observations were the features of this course. Lectures by the Librarians of the Delhi University Library, the Indian Agricultural Research Institute, the Head, Indian National Documentation Centre, National Physical Laboratory and Miss Dorothy Parker of the Rockefeller Foundation were also arranged.

Routine Technical Work. All the books and publications received during the year were classified and catalogued. The number of catalogue cards prepared and filled is 3,400 as against 2,781 in the previous year. The number of volumes compiled and got bound during the year is 1,307 as against 1,043 in the previous year.

Routine Services. The gate register has recorded the visit of 9,979 readers as against 8,584 during the previous year. The number of loan transactions has been 5,780 as against 4,541 in the previous year. Inter-library loan services were extended to several libraries and institutions within and outside Delhi. The Council's Library got on loan 20 books from six libraries and serviced these to the officers of the Council.

Besides answering a large number of ready reference questions with the help of reference works, the library handled 104 reference questions requiring search and location of literature or compilation of bibliographies. Ten bibliographies covering a total of 217 entries were prepared and serviced during the year. Current issues of 170 periodicals were circulated to advisers and other technical officers.

Deputation. The Librarian was deputed to attend the conference of the Indian Association of Special Libraries and Information Centres held at Calcutta

and the Indian Standards Convention held at Hyderabad. Further the Librarian attended all the meetings of the Library Committee of the Indian Standards Institution and the Library Classification Committees of the Insdoc.

Staff. The following posts were created during the year:

One post of Assistant Librarian in grade III to assist the Librarian in implementing the recommendations of Dr. Shaw's report.

One post of Librarian, grade I to take charge of Documentation work and Service, he had not yet reported to duty during the year under report.

(3) **Statistics.** Library Statistics for the year under report is as follows:

		1958-59	1959-60
Books and publications added	..	1,231	1,717
Current periodical issues received	.. ..	11,000	13,239
Number of reports received	.. ..	424	549
Number of bulletins etc., received	.. ..	4,076	4,597
Newspapers received	.. ..	5,727	5,820
Number of readers	.. ..	8,584	9,979
Number of loan transactions	.. ..	4,541	5,780
Consultation service	.. ..	23,106	23,000
Number of publications classified	.. ..	800	900
Number of catalogue cards prepared more than	..	2,781	3,400
Number of bibliographical lists prepared	.. ..	10	10
Number of entries in these	.. ..	566	520
Number of documentation lists	.. ..	2	2
Number of entries in these	.. ..	406	800
Number of advisory circular letters	.. ..	2	4
Number of library service leaflets	.. ..	2	..
Number of publications got bound	.. ..	1,043	1,347

Appendices

APPENDIX 1

SCHEMES WHICH WERE SANCTIONED TO BE CONTINUED

Sl. No.	Name of the Scheme	Sponsoring/Government Authority
(AGRICULTURAL SCHEMES)		
1.	Physiology of rice plant in relation to nutrient deficiency	.. Calcutta University
2.	Research on boro paddy	.. West Bengal
3.	Evolution of drought resistant strains of paddy ..	.. Madras
4.	Research on deep water paddy, Pulla	.. Andhra Pradesh
5.	Improvement of hill paddy	.. West Bengal
6.	Work on rice in saline areas	.. Andhra Pradesh
7.	Interspecific and Intergeneric Hybridization of Indian Wheats	.. M.A.C.S., Poona
8.	Pre-soaking seeds in nutrient salts	.. Uttar Pradesh
9.	Handbook of Indian Agriculture (Additional funds) ..	.. I.C.A.R.
10.	Smut disease of <i>bajra</i>	.. Institute of Agriculture, Anand, Bombay
11.	Citrus manurial trials, Attari	.. Punjab
12.	Study of virus diseases and disorder of other stone fruits in Kumaon Region, D.S.B. College, Naini Tal	.. Uttar Pradesh
13.	Research on Citrus fruit, Tharsa	.. Bombay
14.	Improvement of <i>ber</i> fruit	.. Madhya Pradesh
15.	Citrus Rootstock Trials at Kodur (Additional funds) ..	.. Andhra Pradesh
16.	Improvement of chillies	.. Madras
17.	Intensification of research work on cashewnut in sandy soils of the east coast	.. Andhra Pradesh
18.	Research on Clove, Nutmeg and Cocoa	.. Madras
19.	Improvement of turmeric	.. Andhra Pradesh
20.	Improvement of turmeric	.. Orissa
21.	Ginger Research	.. Assam

APPENDIX 1—Contd.

Sl. No.	Name of the Scheme	Sponsoring/Government Authority
22.	Zera Research	.. Rajasthan
23.	Unified Scheme for the Control of Kattee of Cardamom	.. Mysore
24.	Control of <i>pan</i> disease	.. Madhya Pradesh
25.	Betelvine Wilt disease	.. Madras
26.	Appointment of Research Fellows for salinity Research	.. B. R. College, Agra
27.	Research on the application of ammonium sulphate to paddy lands	West Bengal
28.	Micro-nutrients in the Punjab Soils	.. Punjab
29.	Nitrogen fixation by leguminous crops	.. Bombay
30.	Studies on reversion of phosphates in laterite soils in the Nilgiris	.. Madras
31.	Study of the fertility index of soils	.. Field Research Station, Bombay
32.	Foliar application of nutrients to crops	.. I.A.R.I.
33.	Standardization of methods of soil analysis (Additional funds)	.. Field Research Station, Bombay
34.	Green Manuring	.. Mysore
35.	Green Manuring	.. Andhra Pradesh
36.	Green Manuring	.. Bihar
37.	Green Manuring (Additional funds)	.. Uttar Pradesh
38.	Studies on the Clay Mineral contents of Indian Soils	.. West Bengal
39.	Cytogenetical studies on maize and sorghum	.. Andhra University
40.	Investigation into and control of Maize Wilt	.. Bihar
41.	Provision of nucleus staff to assist the sorghum specialist in collection of varieties of jowar and their maintenance	.. I.C.A.R.
42.	Improvement of vegetables	.. Andhra Pradesh
43.	Improvement of vegetables (Additional funds)	.. Himachal Pradesh Administration
44.	Miscellaneous Tuber crops and related plants	.. Kerala University
45.	Scheme for building up named reference collection of insect pests	.. Andhra Pradesh
46.	Toxicology and adverse effect of synthetic pesticides	.. Madras
47.	Exploration of toxicity hazards in the use of modern insecticides against cattle and human beings	.. I.A.R.I.
48.	Study of the rate of decomposition of insecticidal deposits	.. Osmania University
49.	Plant Virus Research scheme (Eastern Zone)	.. I.A.R.I.
50.	Fodder Production (Coorg)	.. Mysore

APPENDIX 1—Contd.

Sl. No.	Name of the Scheme	Sponsoring/Government Authority
51.	Fodder Production	West Bengal
52.	Improvement of sheep and Wool on Regional basis	West Bengal
53.	Improvement of sheep and Wool on Regional basis	Uttar Pradesh
54.	Appointment of a liaison officer (sheep and wool)	I.C.A.R.
55.	Study of physiology of the hump, develop and sheath in Indian cattle	West Bengal
56.	Angora goat breeding	Uttar Pradesh
57.	Mutton breeds of goats	West Bengal
58.	Formation of hybrids from early tested inbreds of white Leghorn (Additional funds)	Allahabad Agricultural Institute
59.	Investigating the advantages of producing poultry in larger units ..	Bombay
60.	Survey of Bacteriological quality of milk produced in Kaira District	Kaira District Milk Producers' Union
61.	Mutton breeds of Sheep (Additional Funds)	Andhra Pradesh
62.	Control of liverfluke infection of livestock in extensive low-lying areas	Bihar
63.	Assistant Disease Investigation Officer (Pigs)	Punjab
64.	Control and Eradication of Hump sore	West Bengal
65.	Control and Eradication of Hump sore	Orissa
66.	Study of Microbial flora in fresh-water fish	West Bengal
67.	Selective breeding of Red Purnea Cattle and grading them up with Sindhi bulls	Bihar
68.	Studying the feed requirements of sheep under range and Agricultural conditions	I.V.R.I.
69.	Provision of the Technical and other staff for the co-ordinating officers	I.V.R.I.
70.	Value of urea as a protein substitute in the ration of growing and milch animals	I.V.R.I.
71.	Regional Animal Nutrition Research Centres, etc.	1. N.D.R.I., 2. Agricultural Institute, Anand, 3. West Bengal
ECONOMICS AND STATISTICS		
72.	Study of Mechanised Farming	Banaras Hindu University
73.	Appraisal of overall benefits of improvements in farming and possibilities of budgeting approach to the farm earnings	Bihar
74.	Pilot scheme for study of yield and cultivation practices of fruit crop } (i) Guava in Allahabad District of U.P. (ii) Banana in Malabar District of Kerala	I.C.A.R.
75.	Pilot scheme for study of cultivation practices and yield of mango crop, Uttar Pradesh	I.C.A.R.

APPENDIX 1—Concluded

Sl. No.	Name of the Scheme	Sponsoring/Government Authority
76.	Pilot study of incidence of pests and diseases on rice in Cuttack district, Orissa	.. I.C.A.R.
77.	National Index of Field Experiments	.. I.C.A.R.
78.	Pilot scheme for investigation into cultivation practices and yield of Oranges	.. Bombay
79.	Pilot scheme for maintaining research project Files	.. I.C.A.R.
80.	Maintenance of Statistical Wing (I.A.R.S.) Buildings (Additional funds for payment of Municipal taxes, water and electricity bills etc.)	I.C.A.R.
81.	Printing of quarterly journal 'Statistical Newsletter'	.. I.C.A.R.
82.	Publication of Monthly Hindi Journal 'Kheti'	.. I.C.A.R.
83.	Indian Farming	.. I.C.A.R.
84.	Publication of Quarterly popular journal 'Indian Horticulture'	.. I.C.A.R.
85.	Publication of 'The Indian Potato Journal' (Half-yearly)	.. I.C.A.R.
86.	Supply of Agricultural Information Literature to N.E.S. Blocks	.. I.C.A.R.
87.	Editor's Scheme (Additional funds)	.. I.C.A.R.
88.	Sale arrangements of monographs issued by the Commodity Committees	.. I.C.A.R.
89.	Augmentation of staff for sale and distribution of publications	.. I.C.A.R.
90.	Storage and viability of pollen grains	.. Delhi University
91.	Study of agronomic aspects of jowar	.. Bombay
92.	Micro-nutrient status of soils	.. Poona
93.	Defertilization of eggs	.. I.V.R.I.

APPENDIX 2

NEW SCHEMES SANCTIONED FOR IMPLEMENTATION

Sl. No.	Name of the Scheme	Sponsoring/Government Authority
1.	Improvement of rice	Himachal Pradesh
2.	Micro-biological, chemical and agronomic studies on the soils of Kuttanad	Kerala
3.	Evolving gall-fly resistant varieties of paddy	Andhra Pradesh
4.	Micro-nutrient studies on crop plants	Madras
5.	Opening of one wheat breeding station at Washim in Vidarbha	Bombay
6.	Selection of drought resistant varieties of wheat and barley	Sikkim
7.	Investigation into the role of liopic acid in plant metabolism with radio-active tracers	Bose Research Institute, Calcutta
8.	Improvement of Mungeri Pacha Jonna	Andhra Pradesh
9.	Evolution of drought resistant strains of sorghum	Madras
10.	Morphological, ecological and physiological studies on Algae from Usar Lands	Lucknow University
11.	Plant Physiologists Conference, 1960	I.C.A.R.
12.	Improvement of apple	Madras
13.	Cultivation of legumes in orange orchards	Tripura
14.	Proposal for obtaining the services of an expert in fruit culture from Japan	I.C.A.R.
15.	Pilot project for amelioration of die-back disease of citrus	Sikkim
16.	Development of Floriculture	Sikkim
17.	Improvement and development of Rhododendrons and orchids (Chakrata)	Uttar Pradesh
18.	Grant of financial assistance to Agri—Horticultural Societies in India	I.C.A.R.
19.	Ways and means of helping outstanding nurseries for protecting their valuable collections of flowers	I.C.A.R.
20.	Cultivation of Kutch in Lahaul Valley	Punjab
21.	Role of exchangeable bases and Humus in plant Nutrition	Field Research Station, Bombay
22.	Maximisation of phosphate potential in soils	Madras
23.	Biological and Physico-chemical studies in paddy soils	Madras
24.	Bacterisation experiments using phosphobacterin and Azoto-bacterin cultures (Indian and Foreign strains)	I.A.R.I.
25.	Treatment of saline water for irrigation purposes	Punjab
26.	Fundamental studies on mixed cropping	I.A.R.I.

APPENDIX 2—Contd.

Sl. No.	Name of the Scheme	Sponsoring/Government Authority
27.	Study of frequency of irrigation and the relative efficiencies of the three methods of irrigation namely flood, furrow and overhead sprinkler irrigation	Rajasthan
28.	Investigation into the possibility of using sprinkler irrigation system for agricultural purposes in the sandy tracts of coastal	Andhra Pradesh
29.	Physiological studies on water relation of crop plants	Calcutta University
30.	Green Manuring	Madhya Pradesh
31.	Project for investigating and mapping the water budget of India and vicinity and its use in irrigation and flood control	M.J. College, Jalgaon, Bombay
32.	Study of comparative merits of Hyperphosphate and bonemeal against rock phosphate fertilizer in acid soil regions of Kerala, Mysore, West Bengal and Assam	I.C.A.R.
33.	Ley farming	Uttar Pradesh
34.	Development of hybrid maize	Sikkim
35.	Production of Hybrid Maize Seeds at the Central Mechanised Farm, Suratgarh	I.C.A.R.
36.	Development of Mushroom Cultivation	Himachal Pradesh
37.	Production of Foundation Seeds of Temperate Region Vegetables	Himachal Pradesh
38.	Improvement of Vegetables	Assam
39.	Cytological studies of common vegetables	Calcutta University
40.	Improvement of perennial vegetables	Madras
41.	Improvement of vegetables	Sikkim
42.	Bionomics and habits of parrots	I.A.R.I.
43.	Studies on the comparative efficacy of some fumigants against stored grain pests	I.A.R.I.
44.	Research on fungicides	Uttar Pradesh
45.	A monographic study of the Aspergilli and penicilli of India	Allahabad University
46.	Agronomical investigations on fodder crops	B.R. College, Agra
47.	Study of filter point tube wells	Andhra Pradesh
48.	Printing of All India Survey Report on Indigenous agricultural implements in the country	I.C.A.R.
49.	Development of pyrethrum cultivation	I.A.R.I. (Two Centres)
ANIMAL HUSBANDRY SCHEMES		
50.	Survey of bacteriological quality of milk supply in Jaipur	Rajasthan
51.	Sanitization of dairy utensils under rural conditions and in organized dairies in Allahabad City and in Allahabad District	Allahabad, Agricultural Institute

APPENDIX 2—Contd.

Sl. No.	Name of the Scheme	Sponsoring/Government Authority
52.	Survey of bacteriological quality of milk supply to Haringhata Centre	West Bengal
53.	Developing strains of goats for milk production	Bombay
54.	To produce proven cocks for poultry improvement	Madras
55.	Selective breeding of Asil Breed of Poultry	Andhra Pradesh
56.	Improvement of <i>desi</i> strains of chickens for both egg production and meat by establishing strains and crossing them	I.V.R.I.
57.	Development of duck breeding	Andhra Pradesh
58.	Cheap and durable Poultry Houses	Andhra Pradesh
59.	Incidence of yellow colour in wool produced in northern plains ..	Rajasthan
60.	Sheep production in mixed farming economy	Rajasthan
61.	Evolution of a new type of pigs by cross-breeding	Sikkim
62.	Use of indigenous drugs in Veterinary practice	I.V.R.I.
63.	Investigation of Bovine Lymphangitis	Mysore
64.	Poultry Disease Investigation	Rajasthan
65.	Survey and investigation into diseases of ducks	Andhra Pradesh
66.	Control of liverfluke infection	Jammu and Kashmir
67.	Control of liverfluke infection	Himachal Pradesh
68.	Assistant Disease Investigation Officer (Sheep and Goats) ..	Jammu and Kashmir
69.	Pilot scheme for popularising ready-to-feed balanced Poultry food mixture	Rajasthan
70.	To find out cheap poultry rations and its effect on growth rate, egg production etc.	Bihar
71.	Evolving economic poultry ration	Bombay
72.	Systematic study of poultry nutrition	Punjab
73.	To investigate into the causes of degeneration of Jamunapari goats when taken away from their home tract	Uttar Pradesh
ECONOMICS AND STATISTICS		
74.	Enquiry into effects of lift irrigation	Osmania University
75.	Enquiry into economics of irrigation in Coimbatore district ..	Madras
76.	Operational research for studying the extent to which improved agricultural practices are being adopted and their economics ..	Madras
77.	Conduct of pilot surveys for evaluation of various improved agricultural practices	Uttar Pradesh
78.	Studies in the behaviour of consumption and marketing	Gokhale Institute of Politics and Economics, Poona

APPENDIX 2—Concluded

Sl. No.	Name of the Scheme	Sponsoring/Government Authority
79.	Sample Survey to determine effects of mechanization of fishing craft	Bombay
MISCELLANEOUS		
80.	Utilization of the services of retired scientists in the field of agriculture, animal husbandry and allied sciences	I.C.A.R.
81.	Bulletins on Breeding Procedures in different crop plants ..	I.C.A.R.
82.	Publication of Journal entitled ' Plant Breeding and Genetics News- letter '	I.C.A.R.
83.	Printing of bulletins to be subsidised by the Council ..	I.C.A.R.
84.	Experiments on Chinese Methods of Paddy Cultivation ..	I.C.A.R.
85.	Hybrid jowar Scheme, Viv. Lab., Almora	Uttar Pradesh
86.	Conference on production, distribution and popularisation of improv- ed Agricultural implements	I.C.A.R.
87.	Water requirements of crops	D.V.C.
88.	Symposium on 'Algae '	I.C.A.R.
89.	Participation of the I.C.A.R. in the World Agricultural Fair ..	I.C.A.R.

APPENDIX 3

LIST OF SCHEMES WHICH WERE TERMINATED

Sl. No.	Name of the Scheme					Sponsoring/Government Authority
1.	Improvement of pastures and legumes	..	..	..	..	M.P. (Bombay)
2.	Pulse Breeding	..	..	..	..	West Bengal
3.	Cytogenetical Investigation on fruit trees	..	..	..	..	Calcutta University
4.	Establishment of Fruit Research Stations in Plains	..	..	..	..	Uttar Pradesh
5.	Horticultural investigation	..	..	..	..	U.P. (Chaubattia)
6.	Co-ordinated scheme on the effect of chemicals on the storage of Fruits and Vegetables	..	..	..	..	Assam
7.	Improvement of <i>ber</i> Fruit	..	..	..	..	Saurashtra, Bombay
8.	Induction and study of Amphiploidy in Rice	..	..	..	..	West Bengal
9.	Control of serious diseases on guava	..	..	..	..	Ajmer (Rajasthan)
10.	Tuber crops	..	..	..	..	Mysore
11.	Tuber crops	..	..	..	..	Madras
12.	Improvement of Vegetables	..	..	..	..	V.P. (M.P.)
13.	Chillies Research	..	..	..	..	I.A.R.I.
14.	Chillies	..	..	..	..	Andhra Pradesh
15.	Legumes seed inoculation	..	..	..	..	West Bengal
16.	Nitrogen fixation	..	..	..	..	Andhra Pradesh
17.	Green Manuring Scheme	..	..	..	..	Himachal Pradesh
18.	Water requirements of crops at Central Field Research Station	..	..	..	..	Poona
19.	Storage and viability of pollen grains	..	..	..	..	Delhi University
20.	Investigating the use of distress calls of birds feeding on Grain Crops	..	..	..	..	Bombay
21.	Scheme for studies on Aphidae	..	..	..	..	West Bengal
22.	Pre-soaking seed in Nutrient Salt	..	..	..	..	Indore
23.	Co-ordinated grass land survey scheme	..	..	..	..	I.C.A.R.
24.	Reconciliation of figures of Tobacco crops between Andhra Pradesh and Tobacco Committee	..	..	..	..	I.C.A.R.
25.	Preparing Agricultural handbook for India	..	..	..	..	I.C.A.R.
26.	Conference of Entomological and Mycological Research workers	..	..	..	..	I.C.A.R.
27.	Requisition for a Japanese expert to survey possible sites for laying gardens	..	..	..	..	I.C.A.R.
28.	Preparation of a compendium on the animal nutrition investigation—West Bengal	..	..	..	..	I.C.A.R.

APPENDIX 3—Contd.

Sl. No.	Name of the Scheme	Sponsoring/Government Authority
29.	Manual on Dairying in India	I.C.A.R.
30.	Central Drug Information Bureau	I.C.A.R.
31.	Consideration of the recommendation of the sub-committee of Indigenous drugs	I.C.A.R.
32.	Assignment of Dr. F. Yate, F.A.O. Expert	I.C.A.R.
33.	Grant of Rs. 5,000/- to the Aarey Milk colony for purchase of books	I.C.A.R.
34.	Publication of Dharti-ke-Lal	I.C.A.R.
35.	Spices	West Bengal
36.	Botanical improvement of the essential oil-yielding plants	I.A.R.I.
37.	Phosphorus Nutrition of crops	Andhra Pradesh
38.	D.I.O. (Cattle)	Kerala
39.	D.I.O. (Cattle, Poultry) Pepsu Region	Punjab
40.	A.D.I.O. (Sheep and Goats)	Uttar Pradesh
41.	Use of Stabilizers in Rinderpest and Ranikhet Diseases ..	Uttar Pradesh
42.	Parasitic Diseases	Mysore
43.	Lumber Paralysis	Punjab
44.	Investigation into mastitis	I.V.R.I.
45.	Manufacture of Virus Vaccine	Madras
46.	A.D.I.O. (Poultry)	Andhra Pradesh
47.	Bee Research Station	Madras
48.	Determination of normal worm burden in sheep and goats	Punjab
49.	Investigation of Mastitis	Madras
50.	Defertilization of Eggs	I.V.R.I.
51.	Poultry Research	Kerala
52.	Scheme to evolve methods of Sterilization of scrub cows	I.V.R.I.
53.	Sex behaviour of breeding bulls	Madras
54.	Sex behaviour of breeding bulls	N.D.R.I.
55.	Sex behaviour of breeding bulls	Anand
56.	Sex behaviour of breeding bulls	Bihar
57.	Sex behaviour of breeding bulls	Mysore
58.	Sex behaviour of breeding bulls	Other Centres
59.	Immune Genetics of Indian cattle	I.V.R.I.

APPENDIX 3—Concluded

Sl. No.	Name of the Scheme				Sponsoring/Government Authority
60.	Defining characteristics of breed of sheep	..	..	..	North Gujarat
61.	Pathogenic Bacteria	..	..	..	N.D.R.I.
62.	Dairy Sanitizers	..	..	..	N.D.R.I.
63.	Bacteriological quality of milk	..	..	..	N.D.R.I.
64.	Improvement of quality of shoe upper and industrial leather manufactured by mineral tannages	..	..	..	C.L.R.I.
65.	Chrome-retain leather from cow hides	..	..	..	C.L.R.I.
66.	Fat liquids	..	..	..	C.L.R.I.
67.	Leather Boards from Leather shavings	..	..	..	C.L.R.I.
68.	Improvement of Paddy	..	..	..	M.P.
69.	Rice Breeding	..	..	..	Punjab
70.	Rice Breeding	..	..	..	Jammu and Kashmir
71.	Survey and collection of Paddy	..	..	..	C.R.R.I.

APPENDIX 4

MEETINGS OF THE VARIOUS BODIES OF THE INDIAN COUNCIL OF AGRICULTURAL
RESEARCH HELD DURING 1959-60

Sl. No.	Name of the Body	No. of meetings
1.	Agricultural and Animal Husbandry Regional Committees ..	14
2.	Scientific Committees	23
3.	Working Party on Agriculture	1
4.	Working Party on Animal Husbandry	1
5.	Board of Research	1
6.	Advisory Board	1
7.	Standing Finance Committee	1
8.	Governing Body	1
9.	Annual General Meeting	1
10.	Special General Meetings	4
		48

APPENDIX 5

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

LIST OF MEMBERS OF THE I. C. A. R. SOCIETY

1. SHRI S. K. PATIL,
Minister for Food and Agriculture,
Government of India,
New Delhi (President).
2. DR. P. S. DESHMUKH,
Minister for Agriculture,
Government of India,
New Delhi.
3. SHRI M. V. KRISHNAPPA,
Deputy Minister for Agriculture,
Government of India,
New Delhi.
4. DR. M. S. RANDHAWA, I.C.S.,
Vice-President,
Indian Council of Agricultural Research,
New Delhi.
5. SHRI N. RAMCHAND REDDI,
Minister incharge of Agriculture,
Government of Andhra Pradesh,
Hyderabad-Deccan.
6. SHRI MOINUL HAQUE CHAUDHURY,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Assam,
Shillong.
7. SHRI BIR CHAND PATEL,
Minister incharge of Agriculture,
Government of Bihar,
Patna.
8. SHRI V. P. NAIK,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Bombay,
Sacchivalaya, Bombay-1.
9. SHRI E. P. PA LOSE,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Kerala,
Trivandrum.
10. DR. K. N. KATJU,
Chief Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Madhya Pradesh,
Bhopal.
11. SHRI M. BHAKTAVATSALAM,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Madras,
Fort St. George, Madras.
12. SHRI N. RACHIAH,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Mysore,
Bangalore.
13. SHRI RADHA NATH RATH,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Orissa,
Bhubaneswar.
14. SHRI GIAN SINGH RAREWALA,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Punjab,
Chandigarh.
15. SHRI NATHU RAM MIRDHA,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Rajasthan, Jaipur.
16. SHRI MOHANLAL GAUTAM,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Uttar Pradesh, Lucknow.
17. SHRI TARUN KANTI GHOSH,
Minister incharge of Agriculture,
Government of West Bengal, Calcutta.
18. SHRI SHAMSUDDIN,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Jammu and Kashmir,
Srinagar/Jammu Tawi.
19. SHRI M. PALLAM RAJU,
Minister incharge of Forests,
Fisheries and Animal Husbandry,
Government of Andhra Pradesh, Hyderabad.
20. SHRI JAGAT NARAIN LAL,
Minister incharge of Animal Husbandry and
Veterinary Services,
Government of Bihar, Patna.
21. DR. R. AHMED,
Minister incharge of Animal Husbandry
and Veterinary Services,
Government of West Bengal,
Writers' Building, Calcutta-1.
22. SHRI BHAGWAN SAHAY, I.C.S.,
Chief Commissioner of Delhi,
No. 6, Ludlow Castle Road, Delhi.
23. RAJA BAJRANG BAHADUR SINGH OF BHADRI,
Lt. Governor of Himachal Pradesh, Simla-4.

APPENDIX 5—Contd.

24. SHRI J. N. RAINA, I.A.S.,
Chief Commissioner of Manipur, Imphal.
25. SHRI N. M. PATNAIK, I.A.S.,
Chief Commissioner of Tripura, Agartala.
26. SHRI MAHADEV VINAYAK RAJWADE, I.A.S.,
Chief Commissioner, Andaman and Nicobar
Islands, Port Blair.
27. SHRI C. K. BALAKRISHNAN NAIR,
Administrator, Laccadives,
Minicoy and Amindivi Islands, Kozhikode-4.
28. SHRI D. VISWANATHA REDDY,
M.A., B.Sc., (Edin.),
Director of Agriculture,
Andhra Pradesh, Hyderabad-Deccan.
29. DR. S. R. BAROOAH,
Director of Agriculture,
Assam, Shillong.
30. SHRI B. P. AKHAURY,
Director of Agriculture,
Bihar, Patna.
31. SHRI S. P. MOHITE,
Director of Agriculture,
Bombay State II, Queens Garden, Poona.
32. SHRI P. N. MATHEW, I.A.S.,
Director of Agriculture,
Kerala, Trivandrum.
33. DR. R. J. KALAMKAR,
Director of Agriculture,
Madhya Pradesh, Rewa.
34. SHRI A. VENKATESAN, I.A.S.,
Director of Agriculture,
Madras, P.B. No. 412, Triplicane, Madras-5.
35. SHRI M. MALLARAJ URS,
Director of Agriculture,
Mysore, Bangalore-1.
36. SHRI A. L. NAIR, I.A.S.,
Director of Agriculture and Food Production,
Orissa, Cuttack.
37. DR. ARJUN SINGH, Ph.D.,
Director of Agriculture,
Punjab, Chandigarh.
38. SHRI SAMRATH RAJ,
Director of Agriculture,
Rajasthan, Jaipur.
39. DR. B. K. MUKHERJEE, Ph.D., D.Sc.,
Director of Agriculture,
Uttar Pradesh, Lucknow.
40. DR. H. K. NANDI,
Director of Agriculture,
West Bengal, Writers' Building, Calcutta.
41. SHRI G. M. BUTT,
Director of Agriculture,
Jammu and Kashmir, Srinagar/Jammu Tawi.
42. DR. P. M. N. NAIDU,
Director of Animal Husbandry and Fisheries,
Andhra Pradesh, Hyderabad-Deccan.
43. SHRI M. I. MALIK,
Director of Veterinary Services and Animal
Husbandry, Assam, Gauhati.
44. SHRI S. K. SEN,
Director of Animal Husbandry,
Bihar, Patna.
45. SHRI G. A. SHARMA, I.A.S.,
Director of Animal Husbandry,
204, Wellesly Road, Poona-2.
46. SHRI K. P. R. KARTHA,
Director of Animal Husbandry, Kerala State,
P.B. No. 57, Trivandrum-1.
47. SHRI G. C. JUNEJA,
Director of Veterinary Services and Animal
Husbandry, Madhya Pradesh, Rewa.
48. SHRI D. PATTABHIRAMAN, G.M.V.C., A.I.D.I.,
Director of Animal Husbandry,
Egmore, Madras.
49. DR. K. S. SHETTY,
Director of Animal Husbandry and
Veterinary Services, Mysore, Bangalore.
50. SHRI G. BISWAL,
Director of Animal Husbandry and
Veterinary Services, Orissa, Cuttack.
51. SARDAR PRITAM SINGH BRAR,
Director of Veterinary Services and Warden
of Fisheries,
Punjab, Simla.
52. SHRI B. N. HANDA,
Director of Animal Husbandry,
Rajasthan, Jaipur.
53. SHRI B.N.S. CHOWDHARY, B.Sc., M.R.C.V.S.,
Director of Animal Husbandry,
Uttar Pradesh, Lucknow.
54. SHRI J. M. LAHIRI,
Director of Veterinary Services and
Animal Husbandry,
West Bengal, Calcutta.
55. SHRI GHULAM MOHI-UD-DIN,
Director of Veterinary Services,
Jammu and Kashmir,
Srinagar/Jammu Tawi.
56. DR. L. S. NEGI,
Director of Agriculture,
Himachal Pradesh, Simla-4

APPENDIX 5—Contd.

57. SHRI G. C. NEGI,
Deputy Director of Animal Husbandry,
Himachal Pradesh, Simla-4.
58. SHRI K. R. DAMLE, I.C.S.,
Secretary to the Government of India,
Ministry of Food and Agriculture,
(Dept. of Agri.), New Delhi.
59. SHRI DAHYABHAI VALLABHBHAI PATEL,
Member, Rajya Sabha, 68, Marine Drive,
Bombay; 28, Jor Bagh Nursery, New Delhi.
60. SHRI K. MADHVA MENON,
Member, Rajya Sabha, Padmalayam,
Kozhikode, Malabar, Kerala State;
71, North Avenue, New Delhi.
61. SHRI T. SANGANNA,
Member, Lok Sabha, Rayaguda,
P.O., Rayaguda, District Koraput, Orissa;
149, North Avenue, New Delhi.
62. SHRI M. SHANKARAIYA,
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111, Main Road, Vani Vilas Mohalla,
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14-D, Ferozeshah Road, New Delhi.
63. SARDAR IQBAL SINGH,
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85, South Avenue, New Delhi-2.
64. SHRI P. R. PATEL,
Member, Lok Sabha, Pilaji Ganj,
Mohsana, Bombay State;
15-A, South Avenue, New Delhi-2.
65. SHRI MATADIN KHAITAN,
9-Ramkumar Rakhit Lane,
Calcutta-7.
66. SHRI A. R. FOSTER,
Managing Director, Imperial Chemical
Industries (India) Private Ltd.,
Hamilton House, New Delhi.
67. DR. J. S. PATEL,
Agricultural Commissioner with the
Government of India, I.C.A.R., New Delhi.
68. SHRI L. SAHAI,
Animal Husbandry Commissioner with the
Government of India, I.C.A.R., New Delhi.
69. DR. S. M. SIKKA,
Additional Agricultural Commissioner with
the Government of India, New Delhi.
70. SHRI N. P. CHATTERJEE,
Agriculture Marketing Adviser to the
Government of India, Nagpur.
71. DR. B. P. PAL,
Director, Indian Agricultural Research
Institute, New Delhi.
72. SHRI P. G. PANDE,
Director, Indian Veterinary Research
Institute, Izatnagar, U.P.
73. SHRI S. BHAGVANTAM,
Director, Indian Institute of Science,
Bangalore.
74. DR. R. H. RICHHARIA,
Director, Central Rice Research Institute,
Cuttack.
75. DR. PUSHKARNATH,
Director, Central Potato Research Institute,
Simla.
76. SHRI R. N. DUTTA, I.F.S.,
President, Forest Research Institute and
Colleges, New Forest P.O., Dehra Dun.
77. DR. M. D. PATEL,
Director, Institute of Agriculture, Anand.
78. DR. K. K. IYA,
Director, National Dairy Research Institute,
Karnal.
79. SHRI THAKUR DAS BHARGAVA,
Advocate, Member, Lok Sabha,
Anand Bhavan, Hissar.
80. SHRI T. S. KRISHNAMURTI,
Secretary, Central Board of Forestry, Min.
of Food and Agri., (Department of
Agriculture), New Delhi.
81. PROF. M. S. THACKER,
Director General, Council of Scientific and
Industrial Research, New Delhi.
82. SMT. LILAVATI MUNSHI,
President, All India Women's Central Food
Council (Regd.), Bharatiya Vidya Bhavan,
Chowpatty Road, Bombay-7.
83. SHRI R. C. SONI, I.F.S.,
Inspector General of Forests, Ministry of
Food and Agriculture, New Delhi.
84. SHRI J. S. PATIL, B.A., LL.B.,
Chalisgaon P.O., Distt. East Khandesh,
Bombay State.
85. DR. C. G. PANDIT,
Director, Indian Council of Medical
Research, Medical Enclave, Post Box. No.
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86. DR. A. C. JOSHI,
Vice-Chancellor, Punjab University,
Chandigarh.
87. SHRI K. P. BHATNAGAR,
Vice-Chancellor, Agra University, Agra.
88. DR. P. PARIJA,
Vice-Chancellor, Utkal University,
Cuttack-1.

APPENDIX 5—Concluded

89. DR. SHRI RANJAN, D.Sc., F.N.I.,
Vice-Chancellor, Senate House, Allahabad.
90. SHRI WILSON MAYNE,
General Manager, Kanan Devan Hills
Produce Company Limited, Mannar P.O.,
Kerala State.
91. SHRI U. K. LAKSHMAN GOWDA, B.Sc.,
Unvinkhan Estate, Javali, P.O. Chikamagalur
Distt. Mysore.
92. SHRI K. N. KAIMAL,
Rubber Production Commissioner,
Rubber Board, Kottayam, Kerala. (30-12-61).
93. Director of Remounts, Veterinary and
Farms, Quarter Master General's Branch,
Army Headquarters, New Delhi.
94. DR. B. L. SETHI,
Secretary, Indian Central Cotton Committee,
14-Nicol Road, Ballard Estate, Bombay-1.
(26-8-62).
95. SHRI S. C. MUKHERJEE,
4-A, Bow Bazar Orphanage Lane, P.O. Bow
Bazar, Calcutta. (10-11-62).
96. SHRI B. L. SINGH,
Shellac Brokers, 14, Bentincks Street,
Calcutta-1.
97. DR. T. S. VENKATARAMAN,
56, Thyagaraja Road, Thyagaraja Nagar,
Madras-17.
98. SHRI P. BALARAMA KURUP, B.A.,
P.O. Box No. 74, Kozhikode, Calicut.
99. SHRI MOHANLAL AMBALAL PARIKH,
C/o M/s. Mohanlal Hargovindas and Co.,
51, Dady Sheth Agiary Lane, Bombay-2.
100. SHRI G. U. RAO,
54, Kandappa Chetty Street, Madras-1.
101. SHRI C. T. ITTYACHAN,
Kootanad Estate, Kootanad P.O. Via
Triphala Palghat, Distt. Kerala. (31-3-1961).
102. SHRI MADANMOHAN R. RUIA,
Vice-President, I.C.C.C., C/o M/s. Ram-
narain & Sons Private Ltd., State Building
Annexe, Park Street, Fort, Bombay-1.
103. SHRI J. G. WALTON,
Vice-President, Indian Central Jute Com-
mittee, C/o Thomas Duff & Co. (India)
Private Ltd., 3, Clive Row, Calcutta-1.
104. SARDAR LAL SINGH,
Vice-President, Indian Central Sugarcane
Committee, Village and P.O. Nandpur,
Ludhiana;
7, Kotah House, New Delhi.
105. SHRI K. P. MADHAVAN NAIR,
Member, Rajya Sabha, Vice-President,
Indian Central Coconut Committee,
Ernakulam Mills, Ernakulam.
106. SHRI S. MEHTA,
Vice-President, Indian Central Tobacco
Committee, Station Road, Saharanpur, U.P.
107. SHRI SITARAMA REDDY,
Vice-President, Indian Central Oilseeds
Committee, Satyanarayanapet, Bellary-2.
108. SHRI U. SUBRAYA MALLIA,
Vice-President, Indian Central Arecanut
Committee, C/o M/s. U. Vasudeva Subraya
Mallia & Co. Ltd., P.B. No. 24, Bunder,
Mangalore.
109. DR. R. N. PODUVAL,
Economic and Statistical Adviser,
Department of Agriculture, Government of
India, New Delhi.
110. DR. V. G. PANSE,
Statistical Adviser, I.C.A.R., Library Avenue,
New Delhi-12.
111. DR. N. K. PANIKKAR,
Fisheries Development Adviser to the Govern-
ment of India, Ministry of Food & Agriculture,
(Deptt. of Agriculture), New Delhi.
112. SHRI A. C. BOSE,
Joint Secretary to the Government of India,
Ministry of Finance (Department of Expen-
diture), and Financial Adviser, I.C.A.R.,
New Delhi.
113. SHRI KARTAR SINGH DEWANA, M.L.A.,
Dewana Farm, Amargarh, District Sangrur,
Punjab.
114. SHRI V. C. PALAMSWAMY GOUNDER,
Vellappinar P.O., Coimbatore.
115. COL. G. S. DHILLON,
Dhillon Farm, Shinepuri, Madhya Pradesh.
116. SHRI V. N. KAK,
Vasundhara, Jaipur.
117. DR. M. CHANNA REDDY, M.L.A.,
Anand Niwas, Lalguda, Secundrabad,
Andhra Pradesh.
118. SHRI BABURAO KRISHANJI PATIL,
Land-holder, P.O. Digras, Distt. Yootmal,
Bombay State.
119. SARDAR SATWANT SINGH,
Nasirpur Farm, P.O. Bahadurgarh, Fort,
Patiala.

APPENDIX 6

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

LIST OF MEMBERS OF THE GOVERNING BODY

1. SHRI S. K. PATIL,
Minister for Food and Agriculture, Government of India, New Delhi. (President).
2. DR. P. S. DESHMUKH,
Minister for Agriculture, Government of India, New Delhi.
3. SHRI M. V. KRISHNAPPA,
Deputy Minister for Agriculture, Government of India, New Delhi.
4. DR. M. S. RANDHAWA, I.C.S.,
Vice-President, Indian Council of Agricultural Research, New Delhi.
5. SHRI N. RAMCHAND REDDI,
Minister incharge of Agriculture, Government of Andhra Pradesh, Hyderabad-Deccan.
6. SHRI MOINUL HAQUE CHAUDHURY,
Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Assam, Shillong.
7. SHRI BIR CHAND PATEL,
Minister incharge of Agriculture, Government of Bihar, Patna.
8. SHRI V. P. NAIK,
Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Bombay, Sachivalaya, Bombay-1.
9. SHRI E. P. PA LOSE,
Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Kerala, Trivandrum.
10. DR. K. N. KATJU,
Chief Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Madhya Pradesh, Bhopal.
11. SHRI M. BHAKTAVATSALAM,
Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Madras, Fort St. George, Madras.
12. SHRI N. RACHIAH,
Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Mysore, Bangalore.
13. SHRI RADHA NATH RATH,
Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Orissa, Bhubaneswar.
14. SHRI GIAN SINGH RAREWALA,
Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Punjab, Chandigarh.
15. SHRI NATHU RAM MIRDHA,
Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Rajasthan, Jaipur.
16. SHRI MOHANLAL GAUTAM,
Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Uttar Pradesh, Lucknow.
17. SHRI TARUN KANTI GHOSH,
Minister incharge of Agriculture, Government of West Bengal, Calcutta.
18. SHRI SHAMSUDDIN,
Minister incharge of Agriculture, Animal Husbandry and Veterinary Services, Government of Jammu and Kashmir, Srinagar/Jammu Tawi.
19. SHRI M. PALLAM RAJU,
Minister incharge of Forests, Fisheries and Animal Husbandry, Government of Andhra Pradesh, Hyderabad.
20. SHRI JAGAT NARAIN LAL,
Minister incharge of Animal Husbandry and Veterinary Services, Government of Bihar, Patna.
21. DR. R. AHMED,
Minister incharge of Animal Husbandry and Veterinary Services, Government of West Bengal, Writers' Building, Calcutta-1.
22. SHRI K. R. DAMLE, I.C.S.,
Secretary to the Government of India, Ministry of Food and Agriculture, (Deptt. of Agri.), New Delhi.
23. SHRI BHAGWAN SAHAI, I.C.S.,
Chief Commissioner of Delhi, No. 6, Ludlow Castle Road, Delhi.
24. RAJA BAJRANG BAHADUR SINGH OF BHADRI,
Lt. Governor of Himachal Pradesh, Simla-4.
25. SHRI J. N. RAINA, I.A.S.,
Chief Commissioner of Manipur, Imphal.
26. SHRI N. M. PATNAIK, I.A.S.,
Chief Commissioner of Tripura, Agartala.

APPENDIX 6—Concluded

27. SHRI MAHADEV VINAYAK RAJWADE, I.A.S.,
Chief Commissioner of Andaman and
Nicobar Islands, Port Blair.
28. SHRI C. K. BALAKRISHNAN NAIR,
Administrator, Laccadives, Minicoy and
Amindivi Islands, Kozhikode-4.
29. SHRI K. MADHANA MENON,
Member, Rajya Sabha, Padmalayam,
Kozhikode, Malabar, Kerala;
71, North Avenue, New Delhi.
30. SHRI T. SANGANNA,
Member, Lok Sabha, Rayaguda, P.O.
Rayaguda, District Koraput, Orissa;
149, North Avenue, New Delhi.
31. SHRI M. SHANKARAIYA,
Advocate, Member, Lok Sabha,
111, Main Road, Vani Vilas Mohalla,
Mysore City;
14-D, Ferozeshah Road, New Delhi.
32. SHRI H. SIDDAVEERAPPA,
1082 II Road, P. J. Extension,
Davangere, Mysore State.
33. SHRI S. K. SEN,
Director of Animal Husbandry, Bihar, Patna.
34. SHRI A. C. BOSE,
Joint Secretary to the Government of India,
Ministry of Finance (Department of Expen-
diture), and Financial Adviser, I.C.A.R.,
New Delhi.
35. SHRI THAKUR DASS BHARGAVA,
Advocate, Member, Lok Sabha,
Anand Bhavan, Hissar;
31, Canning Lane, New Delhi.
36. SHRI BABURAO KRISHANJI PATIL,
Land-holder, P.O. Digras, Distt. Yootmal,
Bombay State.
37. SARDAR SATWANT SINGH,
Nasirpur Farm, P.O. Bahadurgarh Fort,
Patiala.
38. DR. M. CHANNA REDDY, M.L.A.,
Anand Niwas, Lalguda,
Secunderabad, Andhra Pradesh.

APPENDIX 7

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

LIST OF MEMBERS OF THE STANDING FINANCE COMMITTEE

1. SHRI K. R. DAMLE, I.C.S.,
Secretary, Ministry of Food and Agriculture,
(Deptt. of Agri.), Government of India,
New Delhi.
2. DR. M. S. RANDHAWA, I.C.S.,
Vice-President, Indian Council of Agricultural
Research, New Delhi.
3. SHRI A. C. BOSE,
Joint Secretary to the Government of India,
Ministry of Finance (Deptt. of Expenditure),
and Financial Adviser, I.C.A.R.,
New Delhi.
4. SHRI M. BHAKTAVATSALAM,
Minister incharge of Agriculture,
Animal Husbandry and Veterinary Services,
Government of Madras, Fort St. George,
Madras.
5. SHRI NATHU RAM MIRDHA,
Minister incharge of Agriculture and Animal
Husbandry and Veterinary Services,
Government of Rajasthan, Jaipur.
6. SHRI THAKUR DASS BHARGAVA,
Member, Lok Sabha,
Anand Bhavan, Hissar;
31, Canning Lane, New Delhi.
7. SHRI T. SANGANNA,
Member, Lok Sabha, Rayaguda,
P.O. Rayguda, District Koraput, Orissa;
149, North Avenue, New Delhi.
8. SHRI SATWANT SINGH,
Nasirpur Farm, Bahadurgarh Fort, Patiala.
9. SHRI S. W. MENSINKAI,
Principal, College of Agriculture, Dharwar,
Mysore State.
10. SHRI BERTIE A. D'SOUZA,
Principal, Madras Veterinary College,
Madras.

APPENDIX 8

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

LIST OF MEMBERS OF THE ADVISORY BOARD

1. DR. M. S. RANDHAWA, I.C.S.,
Vice-President, Indian Council of Agricultural Research, New Delhi.
2. DR. J. S. PATEL,
Agricultural Commissioner with the Government of India,
I.C.A.R., New Delhi.
3. SHRI L. SAHAJ,
Animal Husbandry Commissioner with the Government of India, I.C.A.R.,
New Delhi.
4. DR. S. M. SIKKA,
Additional Agricultural Commissioner with the Government of India,
New Delhi.
5. SHRI J. V. A. NEHEMIAH,
Extension Commissioner, Ministry of Food and Agriculture (Deptt. of Agri.), Government of India, New Delhi.
6. SHRI N. P. CHATTERJEE,
Agricultural Marketing Adviser to the Government of India, Nagpur.
7. DR. R. N. PODUVAL,
Economic and Statistical Adviser,
Department of Agriculture,
Government of India, New Delhi.
8. DR. V. G. PANSE,
Statistical Adviser,
Indian Council of Agricultural Research,
Library Avenue, New Delhi.
9. DR. B. P. PAL,
Director, Indian Agricultural Research Institute, New Delhi.
10. SHRI P. G. PANDE,
Director, Indian Veterinary Research Institute, Izatnagar.
11. SHRI S. BHAGVANTAM,
Director, Indian Institute of Science,
Bangalore.
12. DR. K. K. IYA,
Director, National Dairy Research Institute,
Karnal.
13. DR. R. H. RICHHARIA,
Director, Central Rice Research Institute,
Cuttack.
14. DR. PUSHKAR NATH,
Director, Central Potato Research Institute,
Simla.
15. SHRI D. VISWANATHA REDDY, M.A., B.Sc.,
(Edin.), Director of Agriculture,
Andhra Pradesh, Hyderabad-Deccan.
16. DR. S. R. BAROOAH,
Director of Agriculture, Assam, Shillong.
17. SHRI B. P. AKHAURŸ,
Director of Agriculture,
Bihar, Patna.
18. SHRI S. P. MOHITE,
Director of Agriculture, Bombay State,
11, Queens Garden, Poona.
19. SHRI P. M. MATHEW, I.A.S.,
Director of Agriculture,
Kerala, Trivandrum.
20. DR. R. J. KALAMKAR,
Director of Agriculture,
Madhya Pradesh, Rewa.
21. SHRI A. VENKATESAN, I.A.S.,
Director of Agriculture, Madras, P.B. No. 412,
Triplicane, Madras-5.
22. SHRI M. MALLARAJ URS,
Director of Agriculture,
Mysore, Bangalore-1.
23. SHRI A. L. NAIR, I.A.S.,
Director of Agriculture,
Orissa, Cuttack.
24. DR. ARJUN SINGH, Ph.D.,
Director of Agriculture,
Punjab, Chandigarh.
25. SHRI SAMRATH RAJ,
Director of Agriculture,
Rajasthan, Jaipur.
26. DR. B. K. MUKHERJEE, Ph.D., D.Sc.,
Director of Agriculture,
Uttar Pradesh, Lucknow.
27. DR. H. K. NANDI,
Director of Agriculture, West Bengal,
Writers' Building, Calcutta.
28. SHRI G. M. BUTT,
Director of Agriculture, Jammu and Kashmir,
Srinagar/Jammu Tawi.
29. DR. P. M. N. NAIDU,
Director of Animal Husbandry and Fisheries,
Andhra Pradesh, Hyderabad-Deccan.
30. SHRI M. I. MALIK,
Director of Veterinary Services and Animal Husbandry, Assam, Gauhati.

APPENDIX 8—Concluded

31. SHRI S. K. SEN,
Director of Animal Husbandry,
Bihar, Patna.
32. SHRI G. A. SHARMA, I.A.S.,
Director of Animal Husbandry,
Bombay State, 204, Wellesly Road, Poona-2.
33. SHRI K. P. R. KARTHA,
Director of Animal Husbandry,
Kerala State, P.B. No. 57, Trivandrum-1.
34. SHRI G. C. JUNEJA,
Director of Animal Husbandry and Veteri-
nary Services, Madhya Pradesh, Rewa.
35. DR. D. PATTABIRAMAN, G.M.V.C., A.I.D.I.,
Director of Animal Husbandry,
Madras, Egmore.
36. DR. K. S. SHETTY,
Director of Animal Husbandry and Veteri-
nary Services, Mysore, Bangalore.
37. SHRI G. BISWAL,
Director of Animal Husbandry and Veteri-
nary Services, Orissa, Cuttack.
38. SHRI MOHAN SINGH MALHI,
Director of Veterinary Services and Warden
Fisheries, Punjab, Simla.
39. SHRI B. N. HANDA,
Director of Animal Husbandry,
Rajasthan, Jaipur.
40. SHRI B. N. S. CHOWDHURY, B.Sc., M.R.C.V.C.,
Director of Animal Husbandry,
Uttar Pradesh, Lucknow.
41. SHRI J. M. LAHIRI,
Director of Veterinary Services and Animal
Husbandry, West Bengal, Calcutta.
42. SHRI GHULAM MOHI-UD-DIN,
Director of Veterinary Services,
Jammu & Kashmir, Srinagar/Jammu Tawi.
43. DR. L. S. NEGI,
Director of Agriculture,
Himachal Pradesh, Simla-4.
44. SHRI G. C. NEGI,
Deputy Director of Animal Husbandry,
Himachal Pradesh, Simla-4.
45. SHRI R. N. DUTTA, I.F.S.,
President, Forest Research Institute and
Colleges, New Forest P.O.,
Dehra Dun.
46. SHRI J. S. PATIL, B.A., LL.B.,
Chalisgaon P.O., Distt. East Khandesh,
Bombay State.
47. DR. C. G. PANDIT,
Director, Indian Council of Medical Research,
Medical Enclave, New Delhi.
48. DR. A. C. JOSHI,
Vice-Chancellor, Panjab University,
Chandigarh.
49. SHRI K. P. BHATNAGAR,
Vice-Chancellor, Agra University,
Agra.
50. DR. P. PARIJA,
Vice-Chancellor, Utkal University,
Cuttack-1.
51. DR. SHRI RANJAN, D.Sc., F.N.I.,
Vice-Chancellor, Senate House,
Allahabad.
52. SHRI W. WILSON MAYNE,
General Manager, Kanan Devan Mills
Produce Co. Ltd., P.O. Munuar,
Kerala.
53. DR. B. L. SETHI,
Secretary, Indian Central Cotton Committee,
14-Nicol Road, Ballard Estate, Bombay-1.
54. SHRI S. C. MUKHERJEE,
4-A Bowbazar, Orphanage Lane,
P.O. Bowbazar, Calcutta.
55. SHRI B. L. SINGH,
Shellac Brokers, 14, Benhuck Street,
Calcutta.
56. DR. T. S. VENKATARAMAN,
56, Thyagaraja Road,
Thyagaraja Nagar, Madras-17.
57. SHRI P. BALARAMA KURUP, B.A.,
P.O. Box No. 74, Kozhikode (Calicut).

APPENDICES A₁—A₄

APPENDIX

ANNUAL ACCOUNT FOR

I.C.A.R.

RECEIPTS

Head of Account	Receipt during the year	Total Receipts (Rs.)	Grants	
			Original Budget Estimates	Net Revised Estimates
1	2	3	4	5
<i>Opening Balances</i>		30,83,639·23		
(i) Cash Balance	802·98	..	1,20,000	1,36,000
(ii) Bank Balance	29,85,296·09	..	10,000	7,000
(iii) Prov. Fund Balance ..	97,540·16	..	17,390	54,200
Total ..	30,83,639·23			
I. <i>Receipt under the A.P.C. Act</i>	..	49,46,604·00	210	2,800
II. <i>Contribution and Grants</i>	..	..	..	11,640
(a) From constituent States ..	Nil	..	60,000	4,04,400
(b) From Central Government ..	..	7,55,235·00	20,000	13,300
1. Production of Agricultural Films.. ..	2,00,000·00	..	2,00,000	2,16,700
2. Weed Control	2,700·00	..	500	..
3. Cost of milk production ..	1,47,400·00	..	1,30,000	94,200
4. Manurial and Agronomic Trials	54,000·00	..	10,000	4,500
5. Publicity and propaganda under Rinderpest ..	25,000·00	..	300	800
6. Cattle Sterility Scheme ..	12,352·00	..	..	..
7. Wheat Rust Control ..	6,208·00	..	..	..
8. Research-cum-testing Centres for bullock-driven Agricultural implements	27,100·00	..	..	..

'A 1'

THE YEAR 1959—60

(RESEARCH SIDE)

PAYMENTS

Payments		Excess (—) or Savings (+) over net grants (Difference)		Remarks
Head of Accounts	Actuals			
6	7	8		9
<i>Standing Charges</i>				Inconsiderable (a)
1. Accounts Audit	1,36,183·99	(—) 183·99		(a)
2. Travelling allowance of non-official members of the Council	10,389·19	(—) 3,389·19		..
3. Travelling allowance of members of the Committees of the Advisory Board and of other persons invited to attend the meetings	54,119·92	(+) 80·08		..
4. T.A. of non-official members of the Board of Agriculture and A.H. in India	2,796·14	(+)		(a)
5. Misc. grant of V.P.	11,874·30	(—) 234·30		(a)
6. Editorial staff for Indian Farming and Kheti	4,03,866·46	(+) 533·54		(a)
7. Subsidies to various journals ..	13,221·00	(+) 79·00		(a)
8. Integrated statistical Scheme ..	2,16,808·87	(—) 108·87		(a)
9. Publication of abstracts for Indian Journal of Veterinary Science	150·00	(—) 150·00		(a)
10. Publicity Scheme	95,568·81	(—) 1,368·81		(a)
11. Publication of a quarterly Rice News Teller	4,736·42	(—) 236·42		(a)
12. Award of gold medals to two Statistical Students	740·00	(+) 60·00		..

APPENDIX

	1	2	3	4	5
9. Pilot investigation for collection of Stat. data on yield and extent of Cashewnut cultivation and the practices adopted in its cultivation ..		24,100·00	..	..	..
10. Study of milk yield breeds and management practice of bovine		85,000·00	..	30,000	29,000
11. Research and Development of Pepper and Cashewnut ..		55,000·00	..	1,40,000	1,36,000
12. Pilot Survey for study of cultivation practices of pepper. ..		8,000	..	40,000	48,300
13. Study and Feeding Practices of sheep and yield of wool ..		75,000·00	..	14,000	6,400
14. Scheme for Poultry Practices and Production ..		33,375·00	..	5,540	2,400
Total ..		7,55,235·00			
(c) <i>From Special Grants</i> ..			4,13,968·00		
1. I.C.O.C., Hyderabad ..		3,09,700·00	..	3,920	1,800
2. I.C.C.C., Bombay ..		33,548·00	..	64,420	8,300
3. I.C.T.C., Madras..		2,720·00	..	5,000	..
4. I. C. Coconut Committee, Ernakulam ..		2,000·00	..	26,000	19,200
5. I.C.O.C., Hyderabad ..		2,000·00	..	4,84,330	4,16,450
6. I.C.T.C., Madras ..		2,000·00	..	..	100
7. Indian Lac Cess Committee, Ranchi ..		2,000·00	..	..	..
8. I.C.C.C., Bombay ..		60,000·00	..	20,060	19,100
Total ..		4,13,968·00			

'A 1'—Contd.

	6	7	8	9
13. Award of fellowships to Diploma Course Students in Agri-Statistics	26,735·66	(+)	2,264·34	
14. Establishment of a Central Distribution Section for the publications of the Council ..	1,35,717·92	(+)	282·08	(a)
15. Library	48,130·12	(+)	169·88	(a)
16. Abstraction of Horticultural Literature	6,321·78	(+)	78·22	(a)
17. Research Workers' Conference on Agr. and A.H. ..	2,359·67	(+)	40·33	(a)
Total ..	11,69,720·25			

R—Research-training and publicity under direct control of I.C.A.R.

(i) Agriculture

1. Rice Research Workers' Conference	5,853·91	(—)	5,853·91	Demand of Funds
2. Seminar on recent advances in Agronomy and Soil Science ..	1,883·25	(—)	83·25	(a) received late during the year
3. Co-ordinated grass land Survey Scheme	8,235·33	(+)	64·67	(a)
4. Weed Control	52·00	(—)	52·00	(a)
5. Description of different varieties of fruit	19,161·53	(+)	38·47	(a)
6. Intensification of research in cotton, oil seeds and millets..	4,16,488·11*	(—)	38·11	(a)
7. Reconciliation of figures of Tobacco crops between Andhra Pradesh and Tobacco Committee	80·33	(+)	19·67	(a)
8. <i>Ad hoc</i> Committee on Rice under I.C.A.R. Rice Committee	20,241·51	(—)	1,141·51	(a)

APPENDIX

	1	2	3	4	5
III. <i>Interest from Investment</i>			6,51,387·58		
1. 2½% Loan, 1962 ..	..	26,059·68	..	..	5,400
2. 3% Loan, 1963-65 ..	..	49,361·28	..	..	1,40,000
3. 3% 2nd Victory Loan ..	..	5,652·48	..	6,050	7,700
4. 3¾% Loan 1974 ..	..	1,33,245·00	..	..	7,300
5. 4% Loan 1972 ..	..	74,248·00	..	..	..
6. 3% Loan 1975 ..	..	1,88,808·80	..	..	..
7. 3½% Government N.P.B. 1961		35,310·50	..	5,000	..
8. Fixed Deposit etc. ..	..	55,000·00	..	..	..
9. Interest on current account ..	..	2,300·63	..	25,000	..
10. Interest on Short term Receipts		71,426·21	..	..	..
11. 4% Loan, 1979 ..	..	9,975·00	..	..	..
Total ..		6,51,387·58			
IV. <i>Misc. Receipts</i> ..	..	..	7,98,835·03		
1. Receipts realised from schemes		1,54,851·85			
2. Receipts realised on account of unspent balances of grants made by Council		1,49,165·46			
		3,04,017·31			
(a) Sale of publication ..	..	3,98,922·45*	..	4,000	500
(b) Advertisement ..	..	60,125·03	..	80,000	28,000

*Excludes refund to the Government of India to the extent of Rs. 39,792·91 nP.

' A 1 '—Contd.

	6	7	8	9
9. Co-ordinated Wheat rust control Scheme	5,434.05	(—)	34.05	..
10. Manurial trials and agronomic experiments	47,975.16	(+)	92,024.84	..
11. Spices and Cashewnut Show ..	5,319.46	(+)	2,380.54	..
12. Scheme for preparing Agricultural Handbook for India..	7,236.70	(+)	63.30	(a)
13. Assignment of a Horticulture expert from France ..	..	..	..	..
14. Installation of steam injectors to induce artificial rains ..	..	..	..	..
15. Sprinkling irrigation ..	..	..	..	..
*Headquarters	47,515.38	..	..	..
Patiala centre	63,659.68	..	..	..
I.A.R.I.	61,928.34	..	..	..
Amravati	5,085.15	..	..	..
Kanpur	65,501.29	..	..	..
Hyderabad	60,647.39	..	..	..
Sirsa	57,839.83	..	..	..
Coimbatore	30,924.33	..	..	..
Bilari	12,557.31	..	..	..
Gwalior	6,828.53	..	..	..
Power Kheda	1,000.00	..	..	..
Mohal	1,000.00	..	..	..
Ajmer	1,115.44	..	..	..
Hoshangabad	885.44	..	..	..
Total ..	4,16,488.11			
16. Conference of Entomological and Mycological Research Workers	414.94	(+)	85.06	(a)
17. All India fruit shows ..	27,779.27	(+)	220.73	(a)

APPENDIX

		1	2	3	4	5
(c)	Hostel Rent		8,098·64	..	10,000	..
(d)	Disposal of articles		3,725·86	..	..	..
(e)	Miscellaneous		23,945·74	..	..	..
	Total ..		<u>7,98,835·03</u>		5,800	7,800
V. <i>Debits and Remittances</i>						
1.	Loans and advances		6,127·03	3,68,481·45	20,000	..
2.	Deposits and advances repayable		2,91,740·74	..	1,00,000	73,000
3.	Other deposit and advances repayable		9,662·11	..	..	2,600
4.	Recoveries from Research Side staff on account of Income Tax, Prov. Fund etc.		60,951·57	..	49,000	41,000
				<u>110,18,150·29</u>	..	20,800
	Total Receipts Opening balance		<u>3,68,481·45</u>		..	..
	Addl. Investments and Re-investments			38,00,000·00	5,000	2,000
	Grand Total ..		<u>1,48,18,150·29</u>		5,000	1,600
					..	100
					..	..
					..	..
					..	..
					..	27,200

'A 1'—Contd.

	6	7	8	9
18. Publication of illustrated bulletins giving information about cultivation of individual drug Plants	..	..	..	..
19. Donation of cups in flower show in different regions ..	7,800.00	..	..	..
20. Preparation of a book on flower annals by Sh. L. Desai ..	..	..	..	..
21. Investigation into the method and practices of Farming ..	72,348.51	(+) 651.49	(a)	
22. Survey of Fertilizer practices ..	2,660.41	(—) 60.41	(a)	
23. Co-ordination of Research ..	40,835.17	(+) 164.83	(a)	
24. Co-ordinated, Maize breeding Scheme	20,785.06	(+) 14.94	(a)	
25. Survey for the assessment of possibilities of cut flower business	..	..	..	
26. Implementation of Shri Mori's report on Floriculture in India ..	2,159.29	(—) 139.29	(a)	
27. Seminar on disease of Horticultural Plants ..	1,629.92	(—) 29.92	(a)	
28. F.A.O. Grassland Expert ..	70.17	29.83	(a)	
29. Award of a prize for soil moisture determiner	..	..	..	
30. Distribution of hybrid maize seeds	180.00	(—) ..	..	
31. Requisition for a Japanese expert to survey possible sites for laying gardens ..	..	..	..	
Total ..	7,14,264.08			

(ii) *Animal Husbandry*

1. Appointment of a Liaison officer for Sheep and Wool schemes ..	27,132.12	(+) 67.88	(a)
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APPENDIX

1	2	3	4	5
			..	400
			10,060	11,100
			21,410	1,200
			10,810	24,100
			20,000	1,200
			12,160	10,000
			5,800	9,600
			24,000	500
			5,000	300
			5,770	..
			42,030	74,700
			80,000	57,000
			2,000	..
			..	96,400
			..	87,400
			..	..
			14,240	6,500
			..	..
			2,00,000	2,00,000
			..	20,500

'A 1'—Contd.

	6	7	8	9
2. Assignment of sheep and wool expert of F.A.O. ..	309.92	(+)	90.08	(a)
3. Compilation and publication of Indian Dairy Year Book ..	11,078.68	(+)	21.32	(a)
4. Survey of the Yak and Cattle breeding operations in the interior hilly areas ..	1,152.00	(+)	48.00	(a)
5. Co-ordination of Research on A. H.—Creation of a Co-ordinated Unit	23,022.49	(+)	1,077.51	(a)
6. Intensified supervision and co-ordination on cattle breeding ..	1,511.38	(—)	311.38	(a)
7. Cattle Sterility	10,036.75	(—)	36.75	(a)
8. Expansion of central herd-book Section	9,589.28	(+)	10.72	(a)
9. Central Dairy Information Bureau	432.00	(+)	68.00	(a)
10. Definition of ideal animal I.C.A.R.	250.00	(+)	50.00	(a)
11. Monograph on 'Statistical methods in A.H.'	..	..	..	..
Total ..	84,514.62			
(iii) <i>Miscellaneous</i>				
1. Integrated publicity work ..	74,614.95	(+)	85.05	(a) Inconsiderable
2. National index of field experiments	56,858.92	(+)	141.08	(a)
3. Assignment of Dr. F. Yates F.A.O. experts	449.28	(+)	50.78	(a)
4. Revolving Fund	96,757.21	(—)	357.21	(a)
5. Study of milk yield breeds and management practices of Bovine	87,104.23	(+)	295.77	(a) Includes grant of Rs. 22,000/- made by Madras Government
6. Training Centres of Land Records	..	..	..	..
7. Pilot Sample Survey, Pepper ..	6,325.78	(+)	174.22	(a)
8. Agricultural Exhibition at Ceylon and Amritsar	2,000.00	..	..	..
9. Setting up of Central Co-operative Film Production Unit ..	2,00,489.97	(—)	489.97	(a)
10. Cost of Milk Production in India	20,538.44	(—)	38.44	(a)

APPENDIX

1	2	3	4	5
			10,000	..
			..	700
			10,000	100
			..	1,900
			5,79,910	26,800
			60,000	43,800
			..	5,100
			50,000	700
			1,40,900	58,200
			..	60,500
			..	1,700
			..	1,050
			3,310	4,000
			..	..
			39,000	1,94,000
			10,000	..
			20,000	9,000
			5,050	..
			..	3,900

'A 1'—Contd.

	6	7	8	9
11. Printing of IJAS and IJVS and A.H. at Private presses ..	..	..	..	..
12. Grant to the Aarey Milk Colony for purchase of books ..	703·17	(—)	3·17	(a)
13. Sale arrangements of the monographs of Commodity Committees	78·80	(+)	21·20	(a)
14. Printing of quarterly Journal Statistical News Letter ..	1,857·47	(+)	42·53	(a)
15. Building of the I.C.A.R. ..	25,730·74	(+)	1,069·26	(a)
16. Indian Council of Agricultural and Veterinary Education ..	43,725·43	(+)	74·57	(a)
17. Preparation of propaganda material for Rinderpest eradication	20,325·60	(—)	15,225·60 (x)	Demands for funds received late during the year.
18. Publicity campaign on Fertilizers	678·94	(+)	21·06	(a)
19. Supply of Agriculture information literature to the National Extension Service Blocks ..	58,175·39	(+)	24·61	(a)
20. Participation of the Council in World Agriculture fair ..	60,345·81	(+)	154·19	(a)
20a. Seminar in Connection with W.A.F.	91·48		91·48	(a)
21. Setting up an Exhibition Unit	1,647·60	(+)	52·40	(a)
22. Crops cutting experiments on oilseeds U.P. and Madras, I.C.A.R.	1,050·00	..	..	..
23. Duplicating Section ..	3,981·60	(+)	18·40	(a)
24. Japanese method of paddy cultivation	..		..	..
25. Research fellowship in Agriculture in Various Institutes	1,93,485·58	(+)	514·42	(a)
26. Award for prizes for improvement in Agricultural Implements.. ..	..		..	..
27. Award of prizes for outstanding Research Work done in the field of Agriculture and A.H. and allied Sciences ..	8,900·00		100·00	(a)
28. Proposal to invite eminent Statisticians under Colombo Plan	..		..	..
29. Survey of indigenous implements	3,853·92		46·08	..

APPENDIX

1	2	3	4	5
			..	..
			5,000	..
			..	..
			..	..
			4,600	7,800
			..	..
			10,000	..
			9,140	..
			44,060	7,800
			19,630	7,100
			..	..
			20,000	9,000
			..	3,300
			40,000	80,500
			80,000	9,100
			20,000	..
			23,500	59,400
			20,900	14,000
			40,000	..

'A 1'—Contd.

	6	7	8	9
30. Conference on production Distribution and popularisation of improved Agricultural Implements	..	..	..	..
31. Statistical analysis of data of Co-ordinated Scheme for survey of Bacteriological qualities of Milk	..	..	..	..
32. Revision of monograph on anatomy of Ox	..	..	..	..
33. Revision on manual on feeding of farm animals	..	..	..	..
34. Pilot Sample Investigation on the cultivation practices and yield on mango crops ..	7,731.23	(+) 68.77	(a)	
35. Membership of International Hides and allied Trades Society ..	..	..	..	..
36. Printing of small digests of important Publication of the Council	..	..	..	..
37. Printing of the monograph on veterinary entomology and Acarology for India ..	3.80	(—) 3.80	(a)	
38. Building of the I.C.A.R. (Statistical wing)	7,704.41	(+) 95.59	(a)	
39. Fellowships in statistics ..	7,060.75	(+) 39.25	(a)	
40. Hand book 'Indian Fodder and Forage Crops'	..	..	..	..
41. Symposium on Algae ..	8,944.15	(+) 53.83	(a)	
42. Pilot Project for Study of yield and cultivation Practices of fruit Crops	3,253.36	(+) 46.64	(a)	
43. Printing of Khethi ..	79,313.73	(+) 686.27	(a)	
44. Estimation of cost of production of Cotton and other rotation Crops	9,069.72	(+) 30.23	(a)	
45. Supply of special publications of the council on subsidized rates ..	..	..	..	..
46. Maintenance of statistical wing Building (I.C.A.R.) ..	59,382.91	(+) 17.09	(a)	
47. Pilot scheme for maintaining research project files ..	13,810.63	(+) 189.37	(a)	
48. Enquiry into factors influencing Crop patterns on individual Farms	..	..	..	..

APPENDIX

1	2	3	4	5
			7,520	..
			25,750	26,400
			2,000	..
			20,660	..
			4,000	2,800
			..	..
			5,000	1,000
			2,000	29,400
			..	45,700
			..	..
			2,100	..
			4,250	2,900
			23,210	..
			20,000	..
			..	300
			80,000	..

'A 1'—Contd.

	6	7	8	9
49. Preparation of reviews on research work done in India in the field of agriculture and animal Husbandry ..	..	..	..	..
50. Publication of a quarterly popular journal on "Indian Horticulture" ..	26,359·11	(+)	40·89	(a)
51. Pilot enquiry for ascertaining the cost of Poultry and egg production ..	..	..	..	..
52. Publication of a Monograph on Rice in India ..	..	..	..	..
53. Publication of Potato Journal	2,796·46	(+)	3·54	(a)
54. Translation into 'Spanish of the book' Statistical methods for Agricultural workers by Dr. Panse and Dr. Sukhatme ..	..	..	..	..
55. Pilot investigation for collection of data on Cardamon, I.C.A.R.	975·81	(+)	24·19	(a)
56. Pilot scheme for study of poultry Practices, I.C.A.R. ..	29,352·89	(+)	47·11	(a)
57. Study of feeding and rearing practices of Sheep and yield of wool, I.C.A.R. ..	45,671·91	(+)	28·09	(a)
58. Preliminary measures for training investigation and preparation of project reports be undertaken at Institute of Agriculture Research Statistics in connection with proposal made in the Five-Year Plan regarding Statistics ..	..	..	..	..
59. Free supply of I.C.A.R. publications to the various agriculture and veterinary colleges in India	..	..	..	..
60. Publication of a quarterly journal on Agricultural Education	2,796·06	(+)	103·94	(a)
61. Printing of Text books for village level workers ..	..	..	..	..
62. Preparation of text books on Entomology and soil science for students in Agricultural colleges, I.C.A.R. ..	..	..	..	..
63. Preparation of Indices of Scientific journal of the I.C.A.R. viz., IJVS & A.H. & IJAS ..	257·74	(+)	42·26	(a)
64. Preparation of a series of monographs on A.H. subjects ..	..	..	..	..

APPENDIX

1	2	3	4	5
			30,200	..
			10,000	..
			4,820	..
			..	3,600
			32,400	..
			30,000	..
			1,000	7,100
			13,000	7,900
			3,100	10,900
			..	2,300
			..	..
			3,000	..
			3,000	..
			20,000	13,900
			8,000	300
			9,000	6,100
			9,000	7,000
			13,000	8,100
			10,000	7,000

'A 1'—Contd.

	6	7	8	9
65. Preparation of an album on Medicinal Plants ..	..	..	..	..
66. Printing of a comprehensive publication on Agricultural Research in India ..	..	..	..	..
67. Preparation of a monograph on different cereal crops ..	..	..	..	..
68. Pilot Scheme for study of incidence of pest and disease of Rice Orissa and I.C.A.R. ..	3,595.05	(+)	4.95	(a)
69. Preparation of books on flowering Shrubs and flowering Creepers	..	..	..	..
70. Reprinting of a Monograph on dry farming in India ..	..	..	..	..
Total ..	12,73,850.03			

C. Grants-in-aid

(i) Agriculture

(a) Rice

1. Improvement of Paddy M.P.	7,040.00	(+)	60.00	(a)
2. Rice Breeding Punjab ..	7,885.07	(+)	14.93	(a)
3. -do- Coorg (Mysore)	10,889.00	(+)	11.00	(a)
4. -do- Kerala ..	2,238.64	(+)	61.36	(a)
5. Insects pests of paddy W. Bengal	..	..	..	..
6. Scheme for breeding short term strains possessing Seed dormancy—Madras ..	..	..	..	..
7. Scheme for influence of metal chelated compounds on the yield of Paddy Madras ..	..	..	..	..
8. Survey and collection of paddy C.P.R.I., Cuttack ..	13,822.10	(+)	77.90	(a)
9. Blast and foot rot diseases of Rice and wheat, Bombay ..	262.00	(+)	38.00	(a)
10. Rice Stem borer Madras	6,080.00	(+)	20.00	(a)
11. -do- Hyderabad (Andhra)	6,930.00	(+)	70.00	(a)
12. -do- W. Bengal ..	8,092.14	(+)	7.86	(a)
13. -do- Andhra ..	6,950.00	(+)	50.00	(a)

APPENDIX

1	2	3	4	5
			5,000	7,000
			13,000	11,000
			..	100
			..	..
			6,080	17,700
			220	7,700
			10,000	..
			6,000	5,600
			3,000	..
			6,000	4,800
			..	600
			5,000	..
			2,000	..
			4,070	..
			..	..
			..	..
			..	..
			1,490	1,600
			9,000	7,000
			9,000	8,600
			..	3,000
			6,000	800
			8,000	4,400
			8,000	..

'A 1'—Contd.

	6	7	8	9
14.	Stem Rot disease of Rice Madras	6,940.00	(+) 60.00	(a)
15.	Boro paddy W. Bengal ..	10,980.00	(+) 20.00	(a)
16.	Breeding salt and flood resistant varieties of Paddy, Assam ..	94.55	(+) 5.45	(a)
17.	-do- (Kerala) ..	..	..	..
18.	-do- (W. Bengal)	17,620.40	(+) 79.60	(a)
19.	Scheme for work on Rice in saline areas Andhra ..	7,700.00	..	..
20.	Cultural studies with upland paddy, West Bengal ..	..	..	..
21.	Blast resistance of paddy, Coimbatore, Madras ..	5,520.00	(+) 80.00	(a)
22.	Investigation on Boro paddy, U.P.	..	..	..
23.	Deep water paddy, U.P. ..	4,800.00	..	(a)
24.	-do- Mysore ..	600.00	..	..
25.	Scheme for evolution of Superior saline and alkaline resistant strains, Madras	..	..	..
26.	Scheme for the improved techni- que of Chinese method of Cul- tivation, U.P.	..	..	..
27.	Hill paddy, U.P. ..	..	..	..
28.	Japanese method of Rice cultiva- tion, Orissa	..	..	..
29.	-do- W. Bengal ..	..	..	..
30.	-do- Madras ..	..	..	..
31.	Drought resistant stains of paddy, Kerala	1,600.00	..	..
32.	-do- Madras ..	6,880.00	(+) 120.00	..
33.	Deep water paddy, Andhra ..	8,599.00	(+) 1.00	(a)
34.	Helminthosporium diseases of Rice, W. Bengal ..	2,980.33	(+) 19.67	(a)
35.	Rice improvement scheme, Kashmir	752.65	(+) 47.35	(a)
36.	Breeding varieties resistant to piricularia, Madras ..	4,362.00	(+) 38.00	(a)
37.	-do- Andhra ..	7,920.00	(+) 80.00	(a)

APPENDIX

1	2	3	4	5
			..	..
			..	4,800
			..	..
			..	..
			..	..
			5,000	..
			2,000	..
			1,000	..
			1,000	..
			1,000	..
			1,000	..
			1,000	..
			1,000	..
			1,000	..
			2,000	..
			1,000	..
			..	..
			1,000	..
			..	..
			6,000	8,700
			2,430	8,700
			3,250	2,800
			2,800	2,000
			20,000	16,000
			9,000	8,000

'A 1'—Contd.

	6	7	8	9
38. Study on paddy Agromyzed Fly Hyderabad (Andhra) ..	..	..	..	..
39. Improvement of hill paddy, Assam	4,705.62	(+) 94.38	(a)	
40. Increasing Rice yield C.R.R.I.	..	..	..	..
41. Study of Nitrogen fixation—blue green Algae in Rice Soils, Madras	..	..	..	..
42. Scheme for Cytological anatomi- cal and entrological studies on rice, C.R.R.I. ..	..	..	..	..
43. Experiment on Chinese method of cultivation A.P. ..	..	..	..	..
44. -do- Assam ..	..	..	..	..
45. -do- Bihar ..	..	..	..	..
46. -do- Bombay ..	..	..	..	..
47. Experiment on Chinese method of cultivation J. & K. ..	..	..	..	..
48. -do- Kerala ..	..	..	..	..
49. -do- M.P. ..	..	..	..	..
50. -do- Madras ..	..	..	..	..
51. -do- Mysore ..	..	..	..	..
52. -do- Punjab ..	..	..	..	..
53. -do- U.P. ..	..	..	..	..
54. -do- Orissa ..	..	..	..	..
55. -do- W. Bengal ..	..	..	..	..
56. Breeding non-lodging non-shad- ing and flood-resistant Paddy, M.P.	8,660.00	(+) 40.00	(a)	
57. Breeding paddy for lift irrigation Areas, Andhra ..	8,630.00	(+) 70.00	(a)	
58. Tabi Nurseries of Paddy, Andhra	2,720.00	(+) 80.00	(a)	
59. Bacterial Blight diseases of paddy Bombay	2,000.00	..	..	..
60. Breeding strains Resistant to lodging of Rice, C.R.R.I. ..	16,000.00	..	..	..
61. Induction and study of Amphi- ploidy in Rice, W. Bengal ..	7,830.00	(+) 170.00	(a)	

APPENDIX

1	2	3	4	5
			3,850	3,500
			6,000	4,300
			50,000	16,400
			10,000	4,200
			..	..
			18,000	15,200
			..	..
			530	..
			20,000	100
			1,300	..
			..	..
			4,200	..
			70,220	60,200
			1,37,380	..
			300	..
			20,760	25,400
			1,260	4,600
			650	..
			300	17,700
			26,350	50,000
			1,33,510	19,000
			..	100
			..	100
			..	400
			50,000	50,000

'A 1'—Contd.

	6	7	8	9
62.	Investigation of false smut of Paddy, Andhra	3,480·00	(+) 20·00	(a)
63.	Evolution of Paddy strains for inundated areas, Madras ..	4,280·00	(+) 20·00	(a)
64.	Evolving improved varieties of Rice, Kerala	16,395·28	(+) 4·72	(a)
	<i>Wheat and other Cereals</i>			
65.	Maize Breeding and Paddy, W. Bengal	4,157·37	(+) 42·73	(a)
66.	Hybrid corn seed, Vivekananda Laboratory, Almora ..	..	..	..
67.	Improvement of Pastures and legumes, I.A.R.I. ..	15,190·00	(+) 10·00	(a)
68.	Nutritive value of wheat, I.A.R.I.	..	..	..
69.	Improvement of pastures and legumes, M.P. (Bombay) ..	..	..	..
70.	-do- Bombay ..	34·64	(+) 65·36	(a)
71.	Foot rot of wheat, Bombay, M.P.	..	..	..
72.	Study on wheat (Bombay) ..	..	..	..
73.	Hybrid Maize, Mysore ..	..	..	..
74.	Co-ordinated Maize breeding scheme, I.A.R.I. ..	60,200·00	..	..
75.	-do- Kashmir .. (—)	1,400·00	(—) ..	..
76.	-do- Mysore ..	..	..	..
77.	-do- W. Bengal ..	25,400·00	..	..
78.	-do- Bihar ..	4,560·00	(+) 40·00	(a)
79.	-do- Punjab ..	..	..	..
80.	-do- Bombay ..	18,542·44	(—) 842·44	(a)
81.	-do- U.P. ..	50,000·00	..	..
82.	-do- Other Centres, Naraingarh (Pb.) ..	18,960·00	(+) 40·00	(a)
83.	Maize Breeding, U.P. ..	74·00	(+) 26·00	(a)
84.	-do- Andhra Pradesh ..	42·00	(+) 58·00	(a)
85.	-do- Rajasthan ..	320·00	(+) 80·00	(a)
86.	Co-ordinated Maize breeding scheme—Rajasthan ..	50,000·00	..	(a)

APPENDIX

1	2	3	4	5
			25,000	24,000
			10,000	75,500
			20,000	..
			45,000	50,100
			..	..
			..	..
			..	..
			9,230	..
			1,060	900
			30,100	..
			1,700	3,800
			..	..
			5,450	1,200
			6,000	..
			7,000	..
			2,000	2,000
			3,500	..
			7,000	8,000
			7,500	4,900
			7,000	2,500
			3,000	..
			4,000	4,200
			1,000	..

'A 1'—Contd.

	6	7	8	9
87.	Co-ordinated Maize breeding Scheme, Vivekananda Laboratory, Almora	23,670·12	(+) 329·88	(a)
88.	-do- Andhra ..	75,448·00	(+) 52·00	(a)
89.	-do- M.P. ..	..	..	..
90.	-do- Punjab (Kangra)	50,050·00	(+) 50·00	(a)
91.	Development of suitable nutritious Pasture grasses and legumes at different altitude and climate conditions, Punjab ..	..	..	..
92.	Fodder Production under rainfed and irrigated conditions, Kerala	..	..	..
93.	Co-ordinated wheat Rust control Bombay (Nimphad) ..	..	..	..
94.	-do- Rajasthan	..	..	..
95.	-do- Vivekananda Lab. Almora	852·43	(+) 47·57	(a)
96.	-do- Andhra ..	..	..	..
97.	Wheat breeding, Rajasthan ..	3,800·00	..	..
98.	Barley improvement, Rajasthan,	..	..	..
99.	Research on fodder production, West Bengal	1,163·73	(+) 36·27	(a)
100.	Research on fodder production, Bihar	..	..	..
101.	-do- Mysore ..	..	..	..
102.	-do- Coorg (Mysore)	1,908·00	(+) 92·00	(a)
103.	-do- Bhopal (M.P.)	..	..	..
104.	-do- Andhra ..	8,000·00	..	..
105.	-do- Madras ..	4,810·00	(+) 90·00	(a)
106.	Cyclogy of Indian Grasses, M.P.	2,500·00	..	..
107.	Scheme for Cytological autometical and embryological studies on wheat, Maize, Phacelus and Cayus, New Delhi ..	..	..	..
108.	Hybrid Jowar, Almora (U.P.)	..	..	..
109.	Improvement of Pasture grasses and legumes, Dharwar (Mysore)	4,120·00	(+) 80·00	(a)
110.	Production of hybrid Maize seed at C.M.F., Suratgarh ..	..	..	..

APPENDIX

1	2	3	4	5
			8,270	9,700
			10,000	20,700
			4,700	3,400
			5,000	..
			6,000	14,300
			10,000	13,300
			..	..
			20,000	..
			2,830	100
			6,700	..
			..	..
			7,230	5,600
			4,700	..
			..	..
			4,000	4,000
			4,000	..
			2,000	..
			..	..
			6,000	9,000
			6,000	5,700
			4,920	6,700
			..	..
			..	..

'A 1'—Contd.

	6	7	8	9
111.	Cytogenetical studies on Maize, Andhra University ..	9,630·00	(+) 70·00	(a)
112.	Cytogenetics of leguminous Crops, Presidency College, Calcutta	20,640·00	(+) 60·00	(a)
113.	Cytogenetics of wild grasses, Madras	3,390·00	(+) 10·00	(a)
114.	Control of wilt of Maize, Bihar	1,930·00	(—) ..	..
115.	Drought resistance in Wheat, M.P.	14,300·00	..	..
	(c) <i>Milletts and Pulses</i>			
116.	Pulse breeding, Madhya Pradesh (Gwalior)	13,300·00	(—) 3·00	(a)
117.	—do— Mysore ..	..	..	..
118.	Hybrid <i>bajra</i> , Bombay ..	..	..	..
119.	Striga attack on Sorghum, Andhra	19·00	(+) 81·00	(a)
120.	Hybrid combu, Madras ..	..	..	..
121.	<i>Jowar</i> and <i>bajra</i> breeding Saurashtra, Bombay ..	..	..	..
122.	Diseases of <i>bajra</i> , Anand Instt.	5,580·12	(+) 19·88	(a)
123.	Investigation on the Pests of Pulses, Bombay ..	..	..	..
124.	Research on storage of pulses, I.A.R.I.	1·00	(—) 1·00	(a)
125.	Evolution of new varieties of <i>Dolichos lablab</i> , Coimbatore Madras	4,000·00	..	..
126.	Improvement of Pulses, Kerala	..	..	..
127.	Scheme for Investigation embryology of Indian Pulses at Vidharbha Maha Vidyala—Amravati (Bombay) ..	..	..	..
128.	Small Millets, Mysore ..	..	..	..
129.	Pulse Research, Assam ..	8,717·44	(+) 282·56	(a)
130.	Improvement of Pulses, Andhra	5,650·00	(+) 50·00	(a)
131.	Pulse Breeding, W. Bengal ..	6,659·03	(+) 40·97	(a)
132.	—do— Orissa ..	..	..	..
133.	—do— Assam ..	..	..	..

APPENDIX

1	2	3	4	5
			..	..
			..	32,000
			13,000	..
			..	..
			..	..
			2,500	..
			34,900	15,400
			6,900	11,000
			19,700	15,000
			11,700	12,800
			1,000	21,000
			8,600	8,000
			..	..
			1,000	4,800
			64,900	..
			44,800	..
			2,400	1,400
			4,200	4,200
			5,000	..
			6,900	..
			6,300	7,000
			2,000	3,000
			2,000	..
			2,000	..

'A 1'—Contd.

	6	7	8	9
134. Pulse Breeding, Andhra ..	..	..	..	..
(d) <i>Fruits</i>				
135. Horticulture, Tharsa (Bombay)	31,880·00	(+) 20·00	(a)	
136. -do- Orissa ..	..	..	..	..
137. -do- Hyderabad (Andhra) ..	..	..	..	..
138. -do- Mysore ..	..	..	..	..
139. -do- H.P. ..	..	..	..	..
140. Orange cultivation ..	15,334·00	(+) 66·00	(a) Inconsiderable	
141. Virus diseases and other disorders of stone hill fruits D.S.B. College, Nainital, U.P.	10,970·00	(+) 30·00	(a)	
142. Banana Research Madras ..	14,901·00	(+) 91·00	(a)	
143. -do- Bombay ..	12,705·53	(+) 94·47	(a)	
144. Banana research, W. Bengal ..	21,200·27	(—) 200·27	(a)	
145. -do- Andhra ..	8,000·00	..	(a)	
146. Yield data from fruit orchards, Kashmir ..	..	..	..	..
147. Citrus Manurial trials, Punjab..	4,756·00	(+) 44·00	(a)	
148. Establishment of Horticultural Plant Introduction Station at Saharanpur, U.P. ..	..	..	..	..
149. -do- Hassarghatha (Mysore) ..	..	..	..	..
150. Cytogenetical studies on grapes and related wild species, Madras	1,380·00	(+) 20·00	(a)	
151. Investigation of root, rot limb breakage, Andhra ..	4,200·00	..	..	..
152. Twig-blight diseases of orange, W. Bengal ..	..	..	..	..
153. Research on pineapples, W. Bengal ..	..	..	..	..
154. Citrus root stock trials, Andhra	7,000·00	..	..	..
155. Date Palm Research, Kutch (Bombay) ..	3,000·00	..	..	..
156. Fruit Preservation, B.R. College Agra ..	..	..	..	..
157. Orange Research, Kerala ..	..	..	..	..

APPENDIX

1	2	3	4	5
			5,000	5,000
			1,000	..
			2,000	..
			65,000	48,000
			29,000	43,500
			8,500	..
			7,700	..
			7,500	7,500
			14,800	8,000
			8,200	6,100
			6,840	4,000
			4,300	9,000
			9,600	13,200
			37,800	24,600
			66,040	72,300
			..	40,000
			2,000	..
			2,000	..
			32,730	12,600
			19,100	14,800
			9,800	1,000
			2,000	..

'A 1'—Contd.

	6	7	8	9
158.	Anab-Shahi grape cultivation, Andhra	5,000·00	..	..
159.	Banana Research Sub-Station, East Khandesh	..	..	..
160.	Papaya Research Station, Bombay	..	..	..
161.	Co-ordinated Study for the application of growth regulat- ing substances in horticulture, Punjab	48,000·00	..	..
162.	-do- Andhra ..	43,500·00	..	..
163.	-do- I.C.C.C.	..	..	..
164.	-do- Kerala ..	..	..	..
165.	Cytogenetical Investigation on fruit trees, Calcutta University	7,500·00	..	..
166.	Banana Research, Kerala ..	7,900·00	(+) 100·00	(a)
167.	Research on pineapple, Kerala	6,060·00	(+) 40·00	(a)
168.	Improvement and stabilization of offseason bearing of Mango in Kanya Kumari, Madras ..	3,900·00	(+) 100·00	(a)
169.	Wilt disease of guava, W. Bengal	8,930·00	(+) 70·00	(a)
170.	Research in Fruits, Kashmir ..	13,200·00	..	..
171.	Investigation in die-back diseases of citrus, I.A.R.I. ..	24,530·00	(+) 70·00	(a)
172.	-do- Coorg (Mysore)	72,288·00	(+) 12·00	(a)
173.	-do- Bombay ..	40,006·10	(—) 6·10	(a)
174.	Embryology and Anatomy of Citrus, Punjab	..	..	..
175.	Subhumid Tropical Fruit Research Station, Andhra ..	..	..	..
176.	Improvement of Date Palm, Punjab	12,596·92	(+) 3·08	(a)
177.	Establishment of Fruit Research Stations in Plains, U.P. ..	14,800·00	..	..
178.	Increase in yield of fruits and Vegetables by Bee-pollination, Bombay	1,000·00	..	..
179.	Training in fruit and Vegetable Preservation, Andhra ..	..	..	..

APPENDIX

1	2	3	4	5
			..	..
			..	..
			..	..
			7,320	4,000
			..	..
			..	..
			5,000	5,500
			6,200	5,000
			1,000	11,400
			4,000	..
			8,000	..
			3,300	1,700
			..	8,400
			1,000	3,000
			6,000	3,000
			1,400	9,500
			9,000	11,600
			..	3,850
			7,500	..
			2,000	..
			1,000	5,700

'A 1'—Contd.

	6	7	8	9
180.	Mycological and Entomological investigations of fruits, U.P. (b) Scheme terminated, Provision settlement of final accounts	..	..	..
181.	Horticultural investigations, U.P. (Chaubattia)	..	..	..
182.	Co-ordinated scheme on the effect of chemicals on the storage of Fruit and Vegetables, C.F.T.R.I.	..	..	..
183.	-do- Assam ..	3,990·00	(+) 10·00	(a)
184.	-do- Punjab ..	..	..	..
185.	Fruit Preservation, Balwant Rajput College, Agra ..	..	..	..
186.	Research on Cashewnuts, Andhra	5,400·00	(+) 100·00	(a)
187.	-do- Bombay	5,000·00	..	..
188.	Bunchy top disease of Bananas, Travancore Cochin (Kerala) ..	11,482·73	(—) 82·73	(a)
189.	Intensification of Research on nuts, Walnuts, peanut etc., H.P.	..	..	..
190.	Selection of nucellar root stocks in citrus species, U.P. ..	..	..	..
191.	Improvement of Ber fruit, Saurashtra, Bombay ..	1,700·00	..	..
192.	-do- V.P. (M.P.)	8,320·00	(+) 80·00	(a)
193.	-do- Pepsu (Pb.)	2,970·00	(+) 30·00	(a)
194.	-do- Ajmer (Rajasthan)	2,990·00	(+) 10·00	(a)
195.	-do- M.P. ..	9,500·00	..	..
196.	Improvement of Ber fruit trees Pepsu, (Punjab)	11,570·00	(+) 30·00	(a)
197.	Training in fruit and vegetable preservation, M.P. ..	3,845·00	(+) 4·90	(a)
198.	Improvement of pineapple by application of growth regulating substances, (Gauhati Uty), Assam	..	..	..
199.	Fruit preservation, Hyderabad (Andhra Pradesh) ..	..	..	..
200.	Research on pests of vegetables and fruit trees, Punjab ..	5,700·00	..	..

APPENDIX

1	2	3	4	5
			6,600	4,900
			6,600	6,500
			3,000	..
			7,000	..
			1,000	..
			1,000	2,000
			3,480	..
			12,100	8,000
			1,870	4,000
			62,000	34,200
			..	..
			..	19,000
			1,190	6,200
			4,200	18,500
			..	..
			..	..
			..	1,000
			8,300	5,600
			2,610	..
			5,000	..
			2,380	..
			3,000	1,000

'A 1'—Contd.

	6	7	8	9
201.	Research on pests of citrus, Aurangabad, Bombay ..	4,900·00	..	..
202.	Investigation of fruit pests, Andhra	6,500·00	..	..
203.	Intensification of Research on subtropical in lower hills of Valley area, H.P. ..	..	..	..
204.	Research on Raisin grapes, Lahul Valley, Punjab ..	..	..	..
205.	Banana Diseases, Madras ..	..	..	..
206.	Fruit preservation, Annamalai Uty	2,000·00	..	..
207.	Chlorosis of Banana, Bombay ..	..	..	..
208.	Evolution of new varieties of Mango, grapes and citrus, Pb.	8,000·00	..	..
209.	Physiological studies on factors governing root formation in cutting, and layering of fruits, Calcutta University ..	4,000·00	..	..
210.	Coordinated scheme for the improvement of muskmelon and watermelon, I.A.R.I. ..	34,160·00	(+) 40·00	(a)
211.	Training in fruit preservation, Bihar	..	..	..
212.	Research on Cashewnuts, Mysore	19,000·00	..	..
213.	—do—	6,150·86	(+) 49·14	(a)
214.	Control of serious diseases of guava, Ajmer (Rajasthan) ..	18,410·00	(+) 90·00	(a)
215.	Fruit preservation, M.P. ..	..	..	..
	(c) <i>Vegetables</i>			
216.	Potato seed certification survey, I.A.R.I.	..	..	..
217.	Tuber Crops, Andhra ..	902·00	(+) 98·00	(a)
218.	—do— Bihar ..	5,520·00	(+) 88·00	(a)
219.	—do— Mysore ..	..	..	..
220.	Anatomical and embryological studies in Potato, C.P.R.I. ..	..	..	..
221.	Investigation on pests of vege- tables, Andhra	..	..	(a)
222.	Tuber crops, Madras ..	916·00	(+) 84·00	(a)

APPENDIX

1	2	3	4	5
			9,200	11,900
			28,500	48,000
			11,400	..
			16,500	12,500
			11,400	4,600
			7,000	5,300
			4,180	4,000
			11,600	9,600
			10,000	11,000
			1,000	1,100
			..	5,700
			11,400	9,600
			15,100	12,000
			2,450	..
			4,000	9,000
			..	1,300
			2,000	..
			..	..
			2,000	..
			2,000	..
			4,000	..
			3,000	..
			2,000	..

'A 1'—Contd.

	6	7	8	9	
223.	Tuber crops, and related plants, T. University	11,811·00	(+)	89·00	(a)
224.	Tapioca and Sweet Potato, Travancore Cochin, (Kerala)	47,431·92	(+)	568·08	(a)
225.	Improvement of Vegetables, Bombay	..		..	..
226.	-do- U.P. ..	12,196·00	(+)	304·00	(a)
227.	-do- Pepsu (Pb.) ..	4,530·18	(+)	69·82	(a)
228.	Onion Research, Andhra ..	5,289·00	(+)	11·00	(a)
229.	Improvement of onion and garlic, W. Bengal	3,950·00	(+)	50·00	(a)
230.	Vegetable research station, Andhra	9,590·00	(+)	10·00	(a)
231.	Improvement of Vegetables, Madras	10,977·00	(+)	23·00	(a)
232.	-do- Kashmir ..	1,015·31	(+)	84·69	(a)
233.	-do- Punjab ..	5,622·82	(+)	77·18	(a)
234.	-do- Hyderabad, (A.P.)	9,570·00	(+)	30·00	(a)
235.	-do- West Bengal	11,932·27	(+)	67·73	(a)
236.	-do- M.P. ..	..		..	..
237.	-do- V.P. (M.P.)	9,000·00		..	..
238.	Improvement of vegetables, H.P.	1,277·01	(+)	22·99	(a)
239.	Cytogenetical Investigation of the important cucurbitaceous Vegetables of Eastern India, Calcutta Uty	..		..	..
240.	Potato Growing areas, I.A.R.I.	139·62	(—)	139·62	(a)
241.	Onion Research, Bombay ..	..		..	..
242.	Agronomic Investigation on a few important Vegetable Agri- culture, Poona	..		..	..
243.	Investigation of Agronomical re- quirement of improved strains of Vegetable crops, Anand ..	..		..	..
244.	Improvement in the nutrition quality of Indian Vegetables, I.A.R.I.	..		..	..
245.	Cultivation of Singhara, Orissa	..		..	..

APPENDIX

1	2	3	4	5
			15,660	10,500
			4,000	..
			4,000	..
			..	500
			4,000	1,200
			..	..
			..	200
			6,000	..
			18,930	..
			17,000	16,300
			24,000	21,000
			..	..
			10,000	15,400
			..	..
			..	..
			10,000	11,400
			..	..
			20,000	..
			2,300	2,300
			5,000	5,000
			9,000	9,500
			9,500	..
			90,000	68,000
			11,950	..
			6,450	2,100

' A 1 '—Contd.

	6	7	8	9
(f) <i>Other Crops</i>				
246.	Chillies Research, I.A.R.I. ..	10,470·00	(+) 30·00	(a)
247.	—do— Mysore ..	..	..	..
248.	—do— Madras ..	..	..	..
249.	Cardamoms, Madras ..	489·37	(+) 10·63	(a)
250.	Ginger, Madras	1,190·00	(+) 10·00	(a)
251.	—do— Kerala	..	..	..
252.	Development of pepper, Kerala	102·75	(+) 97·25	(a)
253.	Zira diseases, Rajasthan ..	..	..	..
254.	Medicinal plants, Assam ..	..	..	..
255.	—do— F.R.I. ..	16,240·00	(+) 60·00	(a)
256.	—do— Kashmir ..	21,000·00	..	..
257.	—do— W. Bengal ..	..	..	..
258.	—do— H.P. ..	15,400·00	..	..
259.	Cashewnut Development, Kerala	..	..	..
260.	—do— Orissa ..	..	..	..
261.	Pepper Research, Panniyur, Kerala	11,370·00	(+) 30·00	..
262.	Establishment of Pepper Research Station, Mysore ..	..	..	..
263.	Establishment of Regional Species Research Station, Coorg (Mysore)	..	..	..
264.	Cultivation and development of Ginger, Kerala ..	2,400·00	(—) 100·00	(a)
265.	Spices, W. Bengal ..	4,900·00	(—) 100·00	(a)
266.	Cloves, Nutmeg and Coco, Madras	9,560·00	(—) 60·00	(a)
267.	Turmeric Research (Revised), Orissa	..	..	..
268.	Botanical improvement of the essential oil yielding Plants, I.A.R.I.	67,800·00	(+) 200·00	(a)
269.	Coordinated schemes for control of Katee disease of cardamom (Kerala) ..	..	..	..
270.	—do— Mysore ..	2,100·00	..	..

APPENDIX

1	2	3	4	5
			2,000	..
			..	..
			42,290	20,000
			21,400	..
			24,000	24,000
			3,500	7,700
			1,490	100
			6,000	6,000
			5,000	4,000
			51,080	70,000
			..	..
			4,300	3,800
			4,000	3,500
			8,000	5,900
			5,000	3,600
			8,000	10,800
			9,000	..
			3,500	7,800
			4,000	..
			16,500	..
			8,500	9,900
			11,500	5,800

'A 1'—Contd.

	6	7	8	9
271.	-do- I.A.R.I. (for ta only)	..	..	..
272.	Cashewnut Research Scheme, Mysore	..	..	..
273.	Establishment of a research station for cardamom (Kerala)	20,000·00	..	..
274.	-do- Mysore ..	..	..	..
275.	Establishment of research station of pepper, Kerala ..	23,750·00	(+) 250·00	(a)
276.	Turmeric, Andhra ..	7,700·00	..	..
277.	Ginger, Assam	97·97	2·03	(a)
278.	Ergot production, W. Bengal ..	6,000·00	..	..
279.	-do- Assam ..	4,000·00	..	..
280.	Composite Research Station for pepper and cardamom and cashewnut, Assam ..	70,076·53	(—) 76·53	(a)
281.	Scheme for deputation of an Officer to East Asian Countries for collecting first hand infor- mation on cultivation and manurial practices of Pepper, Kerala	..	..	..
282.	Chillies, W. Bengal ..	3,800·00	..	..
283.	-do- M.P. (Bombay) ..	3,500·00	..	..
284.	-do- Andhra ..	5,833·00	(+) 67·00	(a)
285.	-do- Hyderabad ..	3,550·00	(+) 50·00	(a)
286.	Control of Hairy Caterpillar of Cardamom, Mysore ..	10,730·00	(+) 70·00	(a)
287.	Improvement of lemon grass, Kerala	..	..	..
288.	Research on Pepper and Car- damom, Orissa	7,750·51	(+) 48·49	(a)
289.	Research on pan, M.P. ..	3·16	(—) 3·16	(a)
290.	Scheme for research and deve- lopment of Vanilla cultivation, Kerala	..	..	..
291.	Cultivation of camphor in Wynad, Kerala	9,900·00	..	..
292.	Establishment of beteline re- search station in Cuddapa, Andhra ..	5,780·00	(+) 20·00	(a)

APPENDIX

1	2	3	4	5
			10,000	..
			10,500	..
			5,000	5,200
			3,860	..
			8,000	7,000
			8,000	8,300
			4,700	1,100
			32,560	..
			3,270	12,000
			..	..
			15,000	14,000
			..	..
			..	..
			18,000	10,000
			12,000	6,700
			16,000	12,900
			20,000	..
			5,000	..
			1,000	..
			2,000	2,000
			9,950	2,000
			..	..
			..	..

' A 1 '—Contd.

	6	7	8	9
293.	Scheme for cultivation of medicinal plants in cinchona plantations, Madras	..	..	..
294.	Research on Turmeric, ginger and elephant foot in Punjab	..	..	..
295.	Ginger Research Scheme in the Himalayan Areas, W. Bengal	5,180.00	(+) 20.00	(a)
296.	—do— Madras	..	..	..
297.	Root Crops, W. Bengal	6,950.00	(+) 50.00	(a)
298.	Spices, Delhi University	8,277.00	(+) 23.00	(a)
	(g) <i>Soils and Manures</i>			
299.	Micronutrients studies, Punjab	1,100.00	..	..
300.	Collection of Soil Survey, I.A.R.I.	..	..	..
301.	Usarland Reclamation, Punjab	11,980.00	(+) 20.00	(a)
302.	Trace elements in Indian soils, I.A.R.I.	..	..	..
303.	Soil standardizations method, Bombay	14,006.10	(—) 6.10	(a)
304.	Soil and plant growth, Agra	..	..	..
305.	Nitrogen fixation in soils, M.P.	..	..	..
306.	Foliar application of nutrient to crops, I.A.R.I.	9,900.00	(+) 100.00	(a)
307.	Study of fertility index of soils, Field Research Station, Bombay	6,640.00	(+) 60.00	(a)
308.	Investigation of Kharland in Bombay State, Bombay	12,900.00	..	..
309.	Reclamation of saline soils, West Bengal	..	..	..
310.	Comparative Efficiency of ammonial and Nitrates Fertilizers on paddy, I.A.R.I.	..	..	..
311.	Soil Structure Studies, Punjab	..	..	..
312.	Scheme for Studies on soil Structure in Andhra Pradesh	2,090.00	(—) 90.00	(a)
313.	Manurial Experiments on Paddy Lands, W. Bengal	2,000.00	..	..
314.	Salinity Research Scheme, B. R. College, Agra	..	..	..
315.	Soil erosion Rajasthan, Jaipur	..	..	..

APPENDIX

1	2	3	4	5
			..	..
			1,600	5,200
			44,620	..
			3,000	..
			9,000	9,000
			490	..
			..	..
			2,000	..
			2,000	..
			9,500	10,000
			4,000	3,800
			..	..
			4,830	2,400
			1,000	4,100
			80,000	25,000
			10,800	20,000
			5,000	3,700
			42,000	..
			60,000	..
			8,460	..
			1,040	3,000
			7,000	5,000

'A 1'—Contd.

	6	7	8	9
316.	Storage of fertilizer, I.A.R.I. ..	..	..	..
317.	Nitrogen Fixation in Soil, Sheila-dhar Institute ..	5,200·00	..	..
318.	Rapid Soil Test, I.A.R.I. ..	..	..	..
319.	Green Manure, U.P. ..	..	..	..
320.	Studies in the cost of reclamation of Kalar (Alkali) lands, Khalsa College Amritsar, Punjab ..	8,988·00	(+) 12·00	(a)
320a.	Possibilities of using carbons in improvement and reclamation of soil Punjab University ..	..	..	..
321.	Trace elements in Indian soils, I.A.R.I. ..	..	..	..
322.	Working out the method of application of liquid ammonia under Village conditions, I.A.R.I. ..	..	..	..
323.	Scheme for Studies on acid soils of Kerala ..	..	..	..
324.	Alkali Reclamation, Andhra ..	9,920·00	(+) 80·00	(a)
325.	Clay mineral contents of Indian soils, W. Bengal ..	3,750·00	(+) 50·00	(a)
326.	Soil Conditioners, W. Bengal ..	..	..	..
327.	Legume seed inoculation, West Bengal ..	2,390·00	(+) 10·00	(a)
328.	Nitrogen fixation, Andhra ..	4,036·00	(+) 64·00	(a)
329.	Usarland reclamation, Lucknow	25,000·00	..	..
330.	Composition of plants in Usarlands, Lucknow Uty ..	20,000·00	..	..
331.	Phosphatic reversion in Niligris, Madras ..	3,650·00	(+) 50·00	(a)
332.	Examining the behaviour of certain additional Chemical fertilizers, I.A.R.I. ..	..	..	..
333.	Saline and Alkaline Control in Punjab soils, Punjab ..	..	..	..
334.	Reclamation of Saline and Alkaline Lands, Madras ..	..	..	..
335.	Phosphorus Nutrition of Crops, Andhra ..	3,000·00	..	..
336.	Nitrogen fixation, Bombay ..	5,000·00	..	..

APPENDIX

1	2	3	4	5
			5,000	..
			3,000	5,000
			2,000	..
			..	..
			..	..
			..	..
			..	2,200
			..	200
			..	..
			..	..
			..	7,600
			..	10,500
			2,000	..
			6,000	..
			..	..
			..	..
			..	8,300
			..	..
			..	2,120
			..	8,600
			..	10,280
			..	..
			..	..
			..	..
			4,100	..

'A 1'—Contd.

	6	7	8	9
337.	Reclamation of Saline and Alkaline lands, Rajasthan ..	..	..	..
338.	Paddy soils, Annamalai, Madras	5,050.00	(—) 50.00	..
339.	Biological Nitrogen fixation, Bombay, Anand ..	..	..	..
340.	—do— Bombay-Poona	..	..	..
341.	—do— Punjab ..	..	..	..
342.	—do— W. Bengal ..	..	..	..
343.	—do— Andhra Pradesh	2,200.00	..	..
344.	Simple Fertilizer trials, Rajasthan (Sumerpur)	192.43	(+) 7.57	(a)
345.	—do— H.P. (Kani-pur)	..	..	..
346.	—do— Kerala (Chala Kundi) ..	1.62	(—) 1.62	(a)
347.	—do— Orissa (Kalahandi)	7,578.65	(+) 21.35	(a)
348.	—do— I.A.R.I. ..	10,400.00	(+) 100.00	(a)
349.	Coordinated Scheme for the use of Chemical and leaf analysis as means of diagnosing nutrient requirement of Crop plants, Kanpur, U.P. ..	..	..	..
350.	—do— Other centres	..	..	..
351.	Model Agronomic Experiments, Bombay	..	..	..
352.	—do— Kerala ..	..	..	..
353.	—do— Orissa ..	8,318.25	(—) 18.25	(a)
354.	—do— Agra (U.P.) ..	..	..	..
355.	—do— Satna (M.P.) ..	2,119.00	(+) 1.00	(a)
356.	—do— Mysore (Virapura)	8,576.16	(+) 23.84	(a)
357.	—do— M.P. (Obdulaguni)	10,275.00	(+) 5.00	(a)
358.	—do— A.P. (Chalvoi) ..	..	..	..
359.	—do— U.P. (Kanpur, Banaras) ..	..	..	..
360.	Model Agronomic Experiments, Burdwan (W. Bengal) ..	..	..	..
361.	Green Manuring Crops, H.P. ..	..	..	..

APPENDIX

1	2	3	4	5
			4,000	3,500
			4,000	..
			4,000	18,300
			..	..
			1,600	5,200
			..	900
			..	3,200
			..	..
			..	..
			8,000	5,800
			490	600
			7,240	..
			2,200	..
			..	..
			3,400	..
			..	11,200
			4,000	3,500
			5,000	6,000
			3,000	6,500
			5,000	10,400
			7,000	..
			5,000	..
			..	..
			10,000	..
			7,000	..

'A 1'—Contd.

	6	7	8	9
362.	-do- Hyderabad (A.P.) ..	3,450.00	(+) 50.00	(a)
363.	-do- Mysore ..	..	..	..
364.	Micronutrients studies of soils, Bombay	18,217.93	(+) 82.07	(a)
365.	-do- Kerala ..	..	..	..
366.	Usarland reclamation, Sheila- dhar Institute, Allahabad ..	5,200.00	..	..
367.	Studies in microflora of soils, I. I. Sc., Bangalore ..	868.00	(+) 32.00	(a)
368.	Manurial Experiments, Bihar ..	3,196.00	(+) 4.00	(a)
369.	-do- M.P. (Bhopal) ..	..	..	..
370.	Azatabactor inoculation of crops, W. Bengal	..	..	..
371.	Intake of different forms of phosphate by Green Manuring crops,—Madras	5,730.00	(+) 70.00	(a)
372.	Standardization of methods for determining (a) Surface area and (b) P. M. value of Soil, Panjab University	530.00	(+) 70.00	(a)
(h) <i>Agronomy</i>				
373.	Investigation into the method of Practices of Farming, Punjab	..	..	..
374.	-do- Rajasthan ..	..	..	..
375.	-do- J. & K. ..	..	..	..
376.	-do- Himachal Pradesh	..	..	..
377.	-do- U.P. ..	11,200.00	..	..
378.	-do- Bihar ..	3,430.00	(+) 70.00	..
379.	-do- Orissa ..	6,000.00	..	..
380.	-do- Andhra ..	6,410.00	(+) 90.00	(a)
381.	-do- Madras ..	10,400.00	..	..
382.	-do- M.P. ..	..	..	..
383.	Green Manuring Scheme, Bihar	3,050.00	..	..
384.	-do- C.R.R.I., Orissa ..	..	..	..
385.	-do- I.C.J.C., Calcutta	..	..	..
386.	-do- H.P. ..	..	..	..

APPENDIX

1	2	3	4	5
			4,000	..
			10,000	..
			5,000	..
			5,000	5,000
			5,000	..
			5,000	..
			1,800	2,900
			3,000	18,800
			11,000	..
			9,200	..
			9,500	..
			4,810	..
			10,000	8,100
			3,000	2,600
			2,720	5,200
			5,000	..
			..	150
			..	22,300
			19,510	..

' A 1 '—Contd.

	6	7	8	9
387.	-do- Andhra ..	..	..	..
388.	-do- Mysore ..	6,150·00	..	..
389.	-do- U.P. ..	6,000·00	..	..
390.	Relation between moisture Contents and fertility level and selected cropping scheme, Allahabad Agricultural Institute	5,000·00	..	..
391.	Research on Placement of fertilizers for Jowar groundnut Cotton etc., Dharwar (Mysore)	7,000·00	..	..
392.	Agronomic Research on black soils region of South India, Madras	..	..	..
393.	Water requirements of crops at Central Field Research Station, Poona	2,850·00	(+) 50·00	(a)
394.	Agronomic aspects of Jowar, Amravati, Bombay ..	17,868·60	(+) 131·40	(a)
395.	Sprinkling irrigation, Coorg, (Mysore)	..	..	..
396.	Agronomic aspects of Green manuring, Bombay ..	6·10	(—) 6·10	(a)
397.	Water requirement of Crops, D.V.C.	..	..	..
	(i) <i>Physiology</i>			
398.	Physiology of Rice flowering, West Bengal	..	..	..
399.	Rice Physiology, Calcutta Uty.	8,100·00	..	..
400.	Storage and viability of pollan grains, Delhi Uty. ..	2,590·00	(+) 10·00	(a)
401.	Use of phytohormones for higher yields, Bombay	5,159·00	(+) 41·00	(a)
402.	-do- Mysore ..	..	..	..
403.	Chemical stimulation of ovules, Delhi Uty.	155·00	(—) 5·00	(a)
404.	Plant physiology and Sub-Station Plant introduction bureau-Vivekanand Laboratory, U.P.	22,220·25	(+) 79·75	(a)
	(j) <i>Entomology</i>			
405.	Intensification of Termite Research, Anand ..	..	..	..

APPENDIX

1	2	3	4	5
			1,950	..
			500	..
			..	6,700
			4,970	100
			930	1,600
			1,280	5,600
			..	..
			5,000	..
			5,000	1,500
			5,000	..
			5,000	..
			5,000	..
			2,000	..
			2,000	..
			3,000	..
			3,000	..
			..	..
			..	..

'A 1'—Contd.

	6	7	8	9
406.	Investigating the use of distress calls of birds feeding on grain Crops, Bombay	..	..	..
407.	Nutritional and Biological studies on Insects, I.A.R.I. ..	..	..	..
408.	Nutritional and Biological studies on Insects, I.A.R.I. ..	6,700.00	..	..
409.	Systematic and Biological studies of ardent fauna, Delhi University	31.00	(+) 69.00	(a)
410.	Augmenting the marmed insect Collection, Agriculture College, Coimbatore	1,550.00	(+) 50.00	(a)
411.	Physiological relationship between insects and their host plants, Delhi University ..	5,530.00	(+) 70.00	(a)
412.	Survey of beneficial Coccinellids and investigations into their utilization in the control of aphid, Coccids and mites pests of crops, Mysore ..	..	..	..
413.	Co-ordinated Scheme Research on the study of field rats, Madras	..	..	..
414.	-do- Punjab ..	1,500.00	..	..
415.	-do- U.P. ..	..	..	..
416.	-do- Andhra Pradesh ..	..	..	..
417.	-do- Bombay ..	..	..	..
418.	Scheme for Investigation on Forage insects Toxonomy, Rajasthan	..	..	..
419.	Studies on Aphids under Dr. S. Banerji, W. Bengal ..	..	..	..
420.	Biology and control of "Aphid" under Dr. A. S. Srivastava, Govt. Entomologist, U.P. ..	..	..	..
421.	Biology and control of "White flies" under Dr. M. Q. Khan, Govt. Entomologist, A.P. ..	..	..	..
422.	Biological and Control of "Mites" under Dr. E. S. Narayanan, I.A.R.I. ..	..	..	..
423.	Toxonomy Studies of "Mites" under Dr. E. S. Narayanan, I.A.R.I.	..	..	..

APPENDIX

1	2	3	4	5
			2,000	..
			5,000	..
			4,000	..
			3,000	..
			3,000	..
			10,000	13,400
			5,000	..
			5,000	..
			13,000	..
			..	..
			14,840	16,800
			3,940	1,000
			..	..
			12,800	13,300
			4,800	7,400
			6,700	..
			5,500	3,100
			6,000	5,000
			32,320	30,000
			43,320	..

'A 1'—Contd.

	6	7	8	9
424. Biological and Control of mites under Shri Joshi, Punjab Govt.		..	..	..
425. Taxonomic studies on "Jasside" under Dr. G. L. Arora, Punjab University		..	..	..
426. Biology and Control of "Aphids" under Dr. G. L. Arora ..		..	..	..
427. Biology and Control of white flies under Dr. K. N. Trehan, Punjab University ..		..	..	..
428. Biology and Control of Mites under Dr. A. C. Sain, Bihar		..	..	..
429. Scheme on Chalcid parasite of Coicids, Muslim University, Aligarh		13,400.00	..	..
430. Termite Research F.R.I. (New Scheme)		..	..	..
431. Nitrogen metabolism of phytopathogenic Fungi, Delhi Uty.		..	..	..
432. Scheme for control of Caterpillar of Cardamom, Mysore ..		..	..	..
433. Morphology and biology of Common paddy cutworm, Aligarh		..	..	..
434. Termite and research scheme (Toxonomy) Zoological Survey of India (Calcutta) ..		16,790.00	(+) 10.00	(a)
435. Study of the rates of decomposition of insecticides deposits Osmania University, Hyderabad		1,000.00	..	..
436. Survey of Cerya purchase I.A.R.I. (Terminated Scheme)		139.62	(—) ..	..
437. Research on fungicides, I.A.R.I.		13,270.00	(+) 30.00	(a)
438. —do— Punjab ..		7,400.00	..	..
439. —do— Poona (Bombay)		..	..	..
440. —do— Coimbatore (Madras) ..		3,060.00	(+) 40.00	(a)
441. —do— West Bengal ..		5,000.00	..	..
442. Exploration of Toxicity hazards in the use of modern insecticides I.A.R.I.		30,000.00	..	..
443. Exploration of Toxicity hazards in the use of modern insecticides of cattle and human beings I.V.R.I.		..	..	..

APPENDIX

1	2	3	4	5
			7,000	6,000
			7,100	5,000
			3,200	2,300
			..	2,700
			4,500	3,900
			12,530	500
			13,580	6,300
			500	4,300
			34,000	20,300
			..	..
			..	..
			..	..
			5,000	4,000
			8,000	6,000
			6,000	..
			8,000	..
			4,000	4,200
			3,000	..
			6,000	..
			12,000	..
			4,000	4,200

'A 1'—Contd.

	6	7	8	9
444.	Scheme for studies on Aphidal, West Bengal	5,750·00	(+) 250·00	(a)
445.	Work on bioassay and other techniques in the study of plant diseases, Madras University ..	5,000·00	..	..
446.	Research on toxicity and adverse effect of Synthetic pesticides, Madras	2,300·00	..	..
447.	Weed Control, B. R. College Agra	2,700·00	..	..
448.	Control of neinatotes on betelvine in Nasik District, Bombay ..	3,900·00	..	..
449.	Termite Research, F.R.I. ..	440·00	(+) 60·00	(a)
450.	—do— I.A.R.I. ..	6,280·00	(+) 20·00	(a)
451.	Building up named reference collection of insect pests at the Agriculture College, Bapala (Andhra)	4,300·00	..	..
452.	Fundamental research on toxi- city and mode of action of insecticides, Panjab University, Hoshiarpur	20,300·00	..	..
(k) <i>Mycology</i>				
453.	Virus diseases, Poona ..	..	..	..
454.	—do— Simla ..	..	..	..
455.	—do— Delhi ..	..	..	..
456.	Zira diseases, Rajasthan ..	4,000·00	..	..
457.	Scheme for studies on spare contents of the atmosphere, Andhra University ..	6,000·00	..	..
458.	Co-ordinated scheme for control of Katee diseases of Cardamom, Bombay	..	..	..
459.	—do— Mysore ..	..	..	..
460.	—do— Kerala ..	4,130·00	(+) 50·00	(a)
461.	—do— I.A.R.I. for T.A. ..	..	..	..
462.	Ergot Production Assam ..	..	..	..
463.	—do— W. Bengal ..	..	..	..
464.	Control of Pan diseases, M.P. ..	4,128·00	(+) 72·00	(a)

APPENDIX

1	2	3	4	5
			15,000	..
			9,000	8,000
			1,000	2,000
			..	..
			7,700	..
			29,000	34,000
			5,000	4,400
			..	..
			..	..
			..	..
			29,800	21,000
			11,800	..
			2,000	..
			3,000	..
			4,000	..
			2,000	..
			5,000	..
			10,000	..
			9,000	..
			9,000	..
			9,000	..

'A 1.'—Contd.

	6	7	8	9
465.	Establishment of betel vine research station (Andhra) ..	..	..	..
466.	Foorki diseases of Cardamom, W. Bengal ..	8,000·00	..	..
467.	Research on Pan, Madras ..	2,000·00	..	..
468.	Taxonomic and physiological studies on the plants parasitic nematodes of Agricultural importance and their control, I.A.R.I. ..	..	..	..
469.	Development of Herbarium cryptogamal orientals, I.A.R.I.	..	..	..
470.	Co-ordinated Plant Virus Scheme, Eastern Zone, I.A.R.I.	34,000·00	..	..
471.	Control of Budha Parasite, B.R. College, Agra ..	4,370·00	(+) 30·00	(a)
472.	School of Research, Calcutta University ..	..	..	..
473.	-do- I.A.R.I. under Dr. Vasudeva ..	..	..	..
474.	Fungicidal Sprays, I.A.R.I. ..	..	..	..
	(1) Floriculture			
475.	Cytogenetical and physiological studies in relation to floriculture, I.A.R.I. ..	21,000·00	..	..
476.	Research and development on floriculture, Punjab (Pepsu) ..	..	..	..
477.	Development of Rose Variety of essential oils, I.A.R.I. ..	..	..	..
478.	Co-ordinated Scheme on floriculture, Andhra ..	..	..	..
479.	-do- I.A.R.I. ..	..	..	..
480.	-do- Mysore ..	..	..	..
481.	-do- other centres ..	..	..	..
482.	Maintenance and preparation of Seeds and bulbs of imported Ornamental Plants, main centre, Srinagar ..	..	..	..
483.	-do- Sub-Centre, Simla ..	..	..	..
484.	-do- Sub-Centre, Mussoorie	..	..	..
485.	-do- Ootacamund ..	..	..	..

APPENDIX

1	2	3	4	5
			2,000	..
			..	..
			..	..
			..	750
			2,000	30,000
			20,000	..
			..	3,400
			1,400	6,900
			..	6,340
			3,800	..
			7,240	..
			2,200	..
			3,400	..
			..	..
			20,000	13,000
			..	..
			..	..
			..	..
			..	..
			30,000	..

'A 1'—Contd.

	6	7	8	9
486. Floriculture, Assam ..	..	..	..	..
(m) <i>General</i>				
487. Introduction of economic plants I.A.R.I.	..	..	..	..
488. Survey of Fertilizer Practices, U.P.	..	..	..	..
489. Monograph on Agriculture in ancient India, I.A.R.I. ..	780·50	(—) 30·30	(a)	
490. Studies of genetics and Variabi- lity of Algae, I.A.R.I. . . .	29,750·00	(+) 250·00	(a)	
491. Pre-soaking seed in Nutrient Salt, Indore	..	..	..	..
492. -do- Vivekanand Lab., Almora	3,410·38	(—) 10·38	(a)	
493. -do- I.A.R.I. ..	6,900·00	..	..	..
494. Survey of Fertilizer Practices, Punjab	6,337·00	(+) 10·00	(a)	
495. -do- M.P. ..	..	..	..	..
496. Investigation into the method of practices of Farming, Punjab	..	..	..	..
497. -do- Rajasthan ..	..	..	..	..
498. -do- Himachal Pradesh ..	..	..	..	..
Total ..	25,40,207·18			

(ii) ANIMAL HUSBANDRY

(a) *Cattle Breeding*

1. Livestock investigation, Punjab	..	..	..
2. Immune Genetic of Indian Cattle, I.V.R.I.	13,000·00	..	..
3. Improvement of Kangayam breed, Madras	..	..	..
4. Cattle improvement and insu- rance, Punjab	..	..	..
5. Causes of degeneration of Indian Cattle, I.V.R.I.	..	..	..
6. Pilot Key Village Scheme, U.P.	..	..	..
7. Comparative Study of Selective breeding of Purnea, Bihar ..	..	..	..

APPENDIX

1	2	3	4	5
			70,000	25,500
			15,000	9,500
			1,00,000	..
			24,000	..
			15,000	..
			30,000	4,400
			30,000	3,200
			..	..
			..	..
			24,000	21,000
			5,000	..
			30,000	6,500
			20,000	..
			26,000	..
			..	9,000
			20,000	..
			36,000	..
			50,000	..
			75,000	34,600

'A 1'—Contd.

	6	7	8	9
8.	Selective breeding and grading-up of cattle, West Bengal ..	25,500·00	..	..
9.	Thickness of skin and distribution of sweat glands of buffaloes in relation to milk production, I.V.R.I. ..	9,500·00	..	..
10.	Camel Farm for the Bikaneri breed and opening of 10 key village centres, Rajasthan ..	..	..	..
11.	Evolving a new type of pigs by cross breeding, U.P. ..	..	..	..
12.	Evolving methods of sterilization of scrub cows, I.V.R.I. ..	..	..	..
13.	Evolving suitable draught capacity measures for bullocks, I.V.R.I. ..	4,400·00	..	..
14.	Selective breeding and grading up of cattle (Kaira type), Orissa ..	3,194·70	(+) 5·30	(a)
15.	Metabolic effects of hormones in relation to included lactation, U.P. ..	..	..	..
16.	Definition of the breed characteristics of Gaolas Cattle and Berari Buffaloes, M.P. ..	..	..	..
17.	Relative value of selective breeding and grading up of unblachery cattle, Madras ..	20,960·00	(+) 40·00	(a)
18.	Determining the age maturity of Indian Bulls, Orissa ..	..	..	..
19.	Rearing on sex behaviour of breeding of bulls, Madras ..	6,500·00	..	..
20.	Rearing on sex behaviour of breeding of bulls, N.D.R.I. ..	..	..	..
21.	-do- Anand ..	..	..	..
22.	Physiology of hump development and sheath of cattle, Veterinary College, Calcutta, W. Bengal ..	9,010·00	(-) 10·00	(a)
23.	Rearing on sex behaviour of breeding of bulls, Bihar ..	..	..	..
24.	-do- Mysore ..	..	..	..
25.	-do- Other Centres ..	..	..	..
26.	Physiological Genetics of Cattle, West Bengal ..	34,537·74	(+) 63·26	(a)

APPENDIX

1	2	3	4	5
			10,000	9,900
			1,02,600	25,000
			8,000	5,000
			2,000	..
			..	14,100
			..	..
			..	..
			12,160	3,400
			..	35,300
			30,000	30,000
			2,00,000	..
			2,000	..
			10,000(k)	20,000
			..	16,500
			5,000	..
			..	8,000
			4,000	300
			20,000	18,200
			..	300
			2,000	15,000
			1,490	..
			20,000	15,000
			12,000	7,000
			22,000	10,500

'A 1'—Contd.

	6	7	8	9
27.	Selective breeding and grading up of indigenous cattle, Orissa	9,825·64	(+) 64·36	(a)
28.	Cattle Breeding Research, H.P.	25,000·00	..	..
29.	Production of sterility in Lab. Animals, C.D.R.I. ..	5,000·00	..	..
30.	Reproduction Studies in Kankrej cows and Sindhi Buffaloes, Anand	..	..	..
31.	Coordinated Cattle Sterility, I.V.R.I.	14,057·00	(+) 43·00	(a)
32.	-do- U.P. ..	..	..	..
33.	-do- Bihar ..	..	..	..
34.	-do- Osmania University ..	3,400·00	..	..
35.	Artificial Insemination, I.D.R.I.	35,312·10	(—) 12·10	(a)
36.	Progeny Testing of Murrah Buffaloes, Bulls, Bombay ..	30,000·00	..	..
37.	Investigations on the Progeny testing of Bulls under Indian Conditions, 2 Units, Calcutta	..	..	..
38.	Cross breeding of Cattle, Andhra	..	..	..
39.	-do- Assam ..	20,000·00	..	..
40.	-do- Madras ..	16,440·00	(+) 60·00	(a)
41.	-do- Bihar ..	..	..	..
42.	Central Artificial Insemination Sub-Station, Calcutta ..	8,000·00	..	..
43.	Cross breeding of Cattle, U.P.	260·47	(+) 39·53	(a)
44.	-do- W. Bengal	18,200·00	..	..
45.	Physiological norms of Indian Cattle, W. Bengal ..	262·00	(+) 38·00	(a)
46.	Cross Breeding of Cattle, Punjab	15,260·47	(—) 260·47	(a)
47.	-do- Kerala ..	..	..	..
48.	Cross breeding of local non-descript Cattle, Andhra ..	15,000·00	..	..
49.	Cross Breeding of Cattle in heavy-rainfall areas (Neyyatukara Centre), Kerala	7,000·00	..	..
50.	Scheme for investigation of the possibility of spreading out the breeding season in Buffaloes, I.V.R.I.	10,500·00	..	..

APPENDIX

1	2	3	4	5
			18,000	10,000
			..	25,500
			16,060	7,300
			12,760	8,900
			4,500	..
			12,000	4,000
			8,950	8,400
			..	1,300
			..	..
			20,000	10,300
			2,030	..
			6,400	7,000
			3,040	12,900
			5,000	19,200
			..	..
			7,000	..
			10,000	10,000
			10,000	..
			..	..
			27,000	..

' A 1 '—Contd.

	6	7	8	9
51.	Cross Breeding of Cattle in hilly and heavy rainfall areas, Mysore	10,000·00	..	..
52.	Scheme for investigating the Comparative Value of grading up with Sindhi Bulls and Cross breeding with Jersey Bulls for increased milk production, Kerala	25,461·00	(+) 39·00	(a)
	(b) Goat and Sheep Breeding			
53.	Development of mutton breeds of sheep, Bombay ..	7,249·00	(+) 51·00	(a)
54.	-do- Chingleput, Madras	8,900·00	..	..
55.	Indigenous Goat breeding, Punjab	..	..	..
56.	Sheep Research Station, Punjab	4,000·00	..	..
57.	Meat and Mahir goat, Bombay	8,389·00	(+) 11·00	(a)
58.	Sheep breeding, Punjab ..	1,214·00	(+) 86·00	(a)
59.	-do- Kashmir ..	..	..	..
60.	Establishment of research units of sheep production in mixed farming, Madras ..	10,300·00	..	..
61.	Angora Goat Breeding, U.P. ..	..	..	..
62.	Improvement of Sheep in Hills, W. Bengal	7,000·00	..	..
63.	Improvement of Goat, Kerala	12,901·00	(—) 1·00	(a)
64.	-do- W. Bengal	19,189·00	(+) 11·00	(a)
65.	Soil analysis for J. & K. Sheep breeding, I.A.R.I. ..	..	..	..
66.	Exploring the possibilities of Mahir Production, Andhra ..	..	..	..
67.	Development of Mutton breeds of Sheep, Andhra ..	10,000·00	..	..
68.	Establishment of research units for study of sheep production in a mixed farming economy, Punjab	..	..	..
69.	Definition of breeds of Sheep, Rajasthan	..	..	..
70.	Sheep and wool improvement on regional basis, U.P. ..	..	..	..

APPENDIX

1	2	3	4	5
			920	8,500
			18,000	22,400
			25,000	16,000
			6,000	5,000
			8,000	..
			35,000	..
			40,000	..
			..	..
			36,140	..
			..	..
			35,000	27,500
			23,000	..
			5,000	..
			2,000	..
			5,180	9,500
			2,410	..
			26,800	15,500
			70,000	55,400
			50,000	30,000
			12,160	26,000
			36,000	25,000

'A 1'—Contd.

	6	7	8	9
71.	Sheep and wool improvement on regional basis, Bombay (Joria Centre)	8,500·00	..	..
72.	-do- Bihar ..	22,400·00	..	..
73.	-do- Madras (Revised)	16,000·00	..	..
74.	Developing strains of goats for Mohir production, Himachal Pradesh	5,000·00	..	..
75.	Development of mutton breeds of sheep, Mysore	..	..	..
76.	Sheep and wool improvement on regional basis, Rajasthan	..	..	..
77.	-do- H.P. ..	..	..	..
78.	-do- Jammu and Kashmir ..	..	..	..
79.	-do- -do- (Revised)	..	..	..
80.	-do- Mysore ..	..	..	..
81.	-do- Bombay (Poona)	27,500·00	..	..
82.	Development strains of goats for Milk Production, Bombay ..	..	..	..
83.	-do- Kerala ..	..	..	..
84.	Scheme to Study of: (a) the heritability and correlation of economic characters in sheep, and (b) the influx of extronment on some of the exotic and Indian breeds of sheep, U.P. .. ..	.. .. ..	.. .. ..	.. .. ..
85.	Defining characteristics of breeds of Sheep, Bombay, North Gujarat	9,420·00	(+) 80·00	(a)
86.	Normal worm burden in Sheep and Wool Punjab ..	..	..	..
	(c) <i>Animal Nutrition</i>			
87.	Animal Nutrition, Punjab ..	15,400·00	(+) 50·00	(a)
88.	-do- Bombay ..	55,384·00	(+) 16·00	(a)
89.	-do- I.D.R.I. (Bangalore)	31,169·00	(—) 1,169·00	(a)
90.	-do- W. Bengal ..	26,000·00	..	..
91.	Utilization of waste products for Feeding of Cattle, Orissa ..	24,660·00	(+) 340·00	(a)

APPENDIX

1	2	3	4	5
			50,000	25,000
			8,800	..
			70,000	33,700
			3,000	26,700
			10,000	6,700
			5,000	..
			5,000	..
			2,000	..
			5,000	..
			3,000	..
			10,000	..
			2,000	..
			2,000	..
			2,000	..
			4,000	..
			5,000	..
			10,000	..
			18,000	..
			1,000	..

'A 1'—Contd.

	6	7	8	9
92.	Urea as a protein substitute, I.V.R.I.	25,000.00	..	..
93.	Influence of trace elements on the health and production capacity of Livestock., I.V.R.I.	..	..	..
94.	Further work on Paddy Straw, I.V.R.I.	33,700.00	..	..
95.	Nutrition requirements of buffaloes, Agra	26,630.00	(+) 70.00	(a)
96.	Scheme for Conducting experi- ments on the Economics of Poultry Ration, Madras ..	6,640.00	(+) 60.00	(a)
97.	-do- Punjab ..	..	..	..
98.	-do- U.P. ..	..	..	..
99.	-do- Mysore ..	..	..	..
100.	Systematic supply of Poultry Ration, Punjab	..	..	..
101.	Scheme on Economics of Poultry Rations, M.P.	..	..	..
102.	Comparative efficiency of Cows and Buffaloes in Milk Produc- tion at different levels of Nutri- tions, Anand	..	..	..
103.	Investigations on the toxic plants and herb lethal to Domestic anima's, Mysore	..	..	..
104.	-do- Madras ..	..	..	..
105.	-do- U.P. ..	..	..	..
106.	Study of Chemical Constituents and Hae-Matological aspects of different breeds, Mysore ..	..	..	..
107.	Development of suitable nutri- tions pasture grasses and legumes at different altitude and climatic conditions, H.P.	..	..	..
108.	Introduction of Annual irrigated pastures on arable Land in Military Farms Wing, Meerut	..	..	..
109.	Studies on the effect of feeding economic balanced comments mixtures as against cotton seeds or cotton seed cakes above buffaloes, Anand ..	..	..	..
110.	Causes of reproductive failure in Buffaloes and Cows during the summer months, U.P. ..	..	..	..

APPENDIX

1	2	3	4	5
			7,000	..
			8,000	..
			30,000	9,800
			10,210	8,400
			60,000	..
			30,000	20,000
			25,000	..
			7,000	..
			1,000	8,000
			..	..
			8,000	8,000
			7,750	..
			..	..
			..	..
			2,520	7,500
			7,000	33,800
			45,400	..
			5,960	..
			..	..

'A 1'—Contd.

	6	7	8	9
111. Investigation on toxic Plants and herbs lethal to domestic animals, Punjab ..	..	..	..	..
112. Pilot Scheme for popularizing ready-to-feed balanced Poultry Feed, Delhi Cantt. ..	..	..	..	..
113. Studies on Food Requirements of Sheep under range and agricultural conditions, I.V.R.I.	9,770·00	(+) 30·00	(a)	
114. Coordinating officer Animal Nutrition, I.V.R.I. ..	8,400·00	..	..	
115. Animal Nutrition Stations provision for Jeeps etc. (to be allotted to various centres) ..	..	..	..	
116. Scheme on the investigation on the Nutritional Requirements of Pigs, I.V.R.I. ..	19,941·00	(+) 59·00	(a)	
117. Investigation on the quality of wool and meat in relation to nutrition of sheep, B.R. College, Agra ..	16,000·00	(—) 16,000·00*	*Demand of Funds received late during the year.	
(d) <i>Animal Pests, Diseases & Cure</i>				
118. Veterinary investigation Officer (Cattle,) Kerala ..	..	..	..	
119. -do- Punjab ..	8,000·00	..	..	
120. -do- W. Bengal ..	..	..	..	
121. -do- Saurashtra and Kutch ..	8,000·00	..	..	
122. -do- Rajasthan ..	..	..	..	
123. -do- Ajmer Merwara ..	..	..	..	
124. -do- Kashmir ..	5·60	(—) 5·60	(a)	
125. -do- Mysore ..	..	..	..	
126. Sheep and goat diseases, Rajasthan ..	7,462·00	(+) 38·00	(a)	
127. Investigating the possibilities of large scale manufacture of M. S. Adjutant Vaccine, I.V.R.I. ..	33,747·00	(+) 53·00	(a)	
128. Investigation of the use of stabiliser in Rinderpest and Ranikhet Vaccine, U.P. ..	..	..	..	
129. V.I.O. (Sheep and Goats) (Hyderabad) Andhra Pradesh ..	..	..	..	

APPENDIX

1	2	3	4	5
			..	..
			..	..
			..	800
			7,000	..
			..	..
			2,000	..
			2,000	..
			1,000	..
			3,980	4,000
			..	..
			700	6,000
			4,000	..
			7,040	..
			..	720
			3,090	3,000
			3,400	..
			50,000	..
			20,000	16,800
			5,000	..
			1,000	..
			2,000	..

'A 1'—Contd.

	6	7	8	9
130.	V.I.O. (Sheep and Goats) Orissa	..	..	..
131.	-do- Mysore ..	..	..	..
131A.	-do- U.P. ..	780.00	(+) 20.00	(a)
132.	Biological Control of Fascioliasis introduction of ducks, Andhra Pradesh	..	..	..
132A.	Study of Fish	258.75	(+) 41.25	(a)
133.	Control and eradication of Equi- zootic Lymphangitis amongst equidae, D.A.R.V.F. ..	..	..	..
134.	Provision of technical and clerical staff to the Coordinating Officer (Mastitis Schemes), I.V.R.I.	..	..	..
135.	Provision of technical and clerical staff to the Coordinating Officer, (Humpsore Schemes), I.V.R.I.	..	..	..
136.	A.D.I.O. Pigs, Punjab ..	4,000.00	..	..
137.	-do- Andhra ..	..	..	..
138.	Manufacture of Virus Vaccine, Madras	6,000.00	..	..
139.	Asstt. Disease Investigation Officer (Camels), Punjab ..	..	..	..
140.	-do- U.P. ..	..	..	..
141.	Improvement of Vaccine, Madras	633.00	(+) 87.00	(a)
142.	Bacteriological flora of bovine genitalia, Orissa ..	3,000.00	..	..
143.	Monograph of Helminth Para- sites of the domesticated ani- mals in India, I.V.R.I. ..	..	..	..
144.	Scheme to study keeping quality of veterinary biological prod- ucts, I.V.R.I.	..	..	..
145.	Control of Brucellosis, Madras	16,726.63	(+) 73.37	(a)
146.	-do- Orissa ..	..	..	..
147.	Investigation and control of Surra, I.V.R.I.	..	..	..
148.	Investigation into Salmonella in India, I.V.R.I.	..	..	..

APPENDIX

1	2	3	4	5
			5,000	..
			8,000	18,000
			8,010	25,000
			1,900	..
			15,000	16,000
			28,850	34,800
			5,500	5,300
			4,000	..
			6,000	10,000
			18,000	8,700
			1,000	..
			5,000	..
			6,000	6,500
			28,000	16,800
			78,060	3,500
			10,000	2,700
			8,000	5,000
			6,000	4,000
			6,700	..
			3,670	1,700

'A 1'—Contd.

	6	7	8	9
149.	Investigations into infectious Coryza and allied conditions in Poultry, I.V.R.I. ..	..	..	..
150.	Rabbies Research and Diagnostic Centre, I.V.R.I. ..	17,840·00	(+) 160·00	(a)
151.	Parasitic diseases, Mysore ..	24,374·00	(+) 626·00	(a)
152.	Fluke disease of Bovine, Mysore ..	..	..	..
153.	Investigation of infectious abortion (Brucellosis), U.P. ..	16,000·00	..	..
154.	Liver fluke and other parasitic infections of Livestock, Bihar ..	34,700·00	(+) 100·00	(a)
155.	Control eradicating of stephonomphalid infestations among cattle Humsore Scheme, Orissa ..	5,472·67	(—) 172·67	..
156.	—do— Assam ..	..	..	..
157.	—do— W. Bengal ..	9,830·00	(+) 170·00	..
158.	Studies on micotic diseases in domestic animals in India, W. Bengal ..	8,640·00	(+) 60·00	(a)
159.	Biology and systematics of Hill Leeches, Delhi University ..	..	..	..
160.	Investigation of Bovine Paraplegia and Paralysis, Mysore ..	..	..	..
161.	Cocidal fauna of Cattle, Bombay ..	6,500·00	..	..
162.	Bearing of nutrition on helminthic infection, I.V.R.I. ..	17,765·50	(—) 1,765·50*	*Demand of funds received late during the year.
163.	Control of bovine Pleuro-Pneumonia, Assam ..	3,472·00	(+) 28·00	(a)
164.	Elucidation of life history of— (i) Parafilaria bovicola, (ii) Setaria digitata including studies on their pathogenicity and Theropensis, Bihar	2,673·00	(+) 27·00	(a)
165.	Investigation of Brucellosis, Bihar ..	5,000·00	..	..
166.	Experimental studies on Bovine Anaesthesia under Indian conditions, Orissa ..	4,000·00	..	..
167.	Disease investigation, Himachal Pradesh ..	..	..	..
168.	Lumber paralysis in Sheep and goat, Punjab ..	1,653·00	(+) 47·00	(a)

APPENDIX

1	2	3	4	5
			..	400
			5,000	..
			2,000	100
			15,000	14,400
			..	..
			6,000	3,900
			8,000	..
			..	..
			..	..
			1,710	..
			5,480	..
			30,000	27,000
			25,000	10,000
			820	3,500
			7,000	..
			10,000	..
			3,000	..
			5,000	..
			5,000	..
			3,000	..

'A 1'—Contd.

	6	7	8	9
168A. Damage caused by tick & Warb flies, I.V.R.I.		364.00	(+) 36.00	(a)
169. Lumber Paralysis in Goats, Orissa		..	..	..
170. Investigation of mastitis, Bombay		102.00	(—) 2.00	(a)
171. -do- I.V.R.I. ..		14,368.00	(+) 32.00	(a)
172. -do- Mysore ..		..	..	..
173. -do- Madras ..		3,900.00	..	..
174. -do- U.P. ..		..	..	..
(c) <i>Dairying</i>				
175. Rapid determination of Fats, etc. of Milk, W. Bengal ..		..	..	..
176. -do- Punjab ..		..	..	..
177. Pathogenic Bacteria, I.D.R.I. ..		..	..	..
178. Preparation of Samtizers, I.D.R.I.		..	..	..
179. Bacteriological quality of milk, Kaira, Bombay		26,740.08	(+) 259.92	(a)
180. Accelerated oxidation test of Ghee, I.D.R.I.		10,000.00	..	..
181. Detection of adulteration and estimation of main constituents of milk, Panjab University ..		3,480.00	(+) 20.00	(a)
182. Etiology of Horn Cancer in Cattle, U.P.		..	..	..
183. Studies on different methods of Chilling Milk, N.D.R.I. Stan- dardization of Methods of estimating		..	..	..
184. Standardization of methods of estimating total solids and solids not fat in Milk by calcula- tion, N.D.R.I.		..	..	..
185. Studies on the preparation of Fermented Milk, N.D.R.I. ..		..	..	..
186. Studies on the manufacture of Cheddar Cheese from Market Milk, N.D.R.I.		..	..	..
187. Preparation and Standardization of rennets of animal and vege- table origin for cheese manu- facture, N.D.R.I.		..	..	..

APPENDIX

1	2	3	4	5
			2,000	..
			3,000	..
			10,000	..
			12,000	..
			2,000	..
			13,000	..
			8,000	..
			17,000	..
			30,000	25,300
			20,940	9,800
			..	..
			43,780	..
			28,000	20,000
			..	..
			30,000	..
			..	..

'A 1'—Contd.

	6	7	8	9
188. Study on the economics of Specialised Dairy Farming under various conditions, N.D.R.I.	..	..	..	..
189. Study of detailed mineral composition and mineral balance in Milk, N.D.R.I. ..	..	..	..	..
190. Study on the economics of Specialised Dairy Farming under various conditions in Anand	..	..	..	..
191. -do- Patiala (Punjab)	..	..	..	..
192. -do- Madras ..	..	..	..	..
193. Survey of bacteriological quality in Trivandrum, Kerala ..	..	..	..	..
194. Standardizing the Process for the manufacture of : 1. Sterilized cream 2. Tinned butter and 3. Refined tinned ghee Kaira Union, Bombay ..	..	..	..	..
195. Manufacture of bovine cured Edam Cheese (ball type) and golden Cheese (Small flat leaf) from standardized buffalo milk, Bombay	..	..	..	..
196. Survey of Bacteriological quality of Milk, Agricultural Institute, Allahabad	25,218·00	(+) 82·00	(a)	
197. Estimation of Milk sucked by calves in unweaned herds, Anand	9,740·00	(+) 60·00	(a)	
198. Testing standard method for analysis of Milk and Milk products, I.D.R.I. ..	..	..	..	..
199. Manufacture of Concentrated Milk of Cooperative Milk Producers Union, Anand ..	..	..	..	..
200. Study of sterilization and flavoured milk Aarey Colony, Bombay	20,000·00	..	..	..
201. Testing standard methods for Milk and Milk Products, Bihar ..	..	..	..	..
202. Survey and bacteriological quality of Milk in Delhi, N.D.R.I.	..	..	..	..
203. Heat resistant flora in Indian Milk, N.D.R.I.	..	..	..	..

APPENDIX

1	2	3	4	5
			..	..
			1,110	..
			..	..
			5,220	..
			..	3,500
			..	..
			3,880	1,800
			30,900	18,000
			9,000	5,600
			1,200	100
			6,500	6,400
			4,500	3,700
			5,000	5,000
			4,500	..
			..	..
			8,000	..
			4,000	..
			..	..
			..	..
			8,000	6,000
			..	..
			3,000	6,600
			3,000	..

'A 1'—Contd.

	6	7	8	9
204.	Standardizing method for the analysis of Ghee, N.D.R.I. ..	..	..	..
	(f) <i>Wool</i>			
205.	Sampling wool for measurement of quality, Poona ..	..	..	..
206.	Trial on graded Wool, Rajasthan ..	..	..	..
207.	Wool analysis, Bihar ..	..	..	..
208.	-do- Bombay, Baroda ..	3,420.89	(+) 79.11	(a)
209.	Washing and grading of wool, Ajmer, Merwara ..	..	..	..
210.	Establishment Utilization of Wool, Madras ..	1,760.00	..	..
	(g) <i>Skins and Hides</i>			
211.	Chemistry of mineral tannages, C.L.R.I. ..	17,874.00	(+) 126.00	(a)
212.	Manufacture of fat liquors, C.L.R.I. ..	5,572.00	(+) 28.00	(a)
213.	Manufacture of Chrome retan leather, C.L.R.I. ..	65.00	(+) 35.00	(a)
214.	Manufacture of leather boards, C.L.R.I. ..	6,318.00	(+) 82.00	(a)
215.	Skin studies of sheep (Co-ordinated scheme), Bombay ..	3,660.00	(+) 40.00	(a)
216.	-do- U.P. ..	5,000.00	..	..
217.	-do- Rajasthan ..	..	..	..
	(h) <i>Poultry</i>			
218.	Influence of climate on performance of Desi strain of fowl, Orissa ..	..	..	..
219.	-do- Madras ..	..	..	..
220.	-do- Kerala ..	..	..	(a) Inconsiderable
221.	Disease of Poultry, Bihar ..	..	..	..
222.	Laying trials of Poultry, I.V.R.I. ..	..	..	..
223.	Coccidiosis in Poultry, I.V.R.I. ..	5,900.00	(+) 100.00	(a)
224.	Poultry research, M.P. ..	..	..	..
225.	-do- Kerala ..	6,530.77	(+) 69.23	(a)
226.	Increased duck production in the Bet areas, Punjab ..	..	..	..

APPENDIX

1	2	3	4	5
			2,000	..
			5,000	..
			7,930	7,000
			90,000	81,300
			20,000	33,000
			8,000	5,400
			50,000	1,400
			1,350	8,000
			12,000	10,500
			..	700
			18,000	15,000
			7,000	..
			2,000	1,800
			3,000	3,500
			2,440	1,700
			3,000	2,000
			..	..
			7,230	11,500
			5,000	..
			6,500	..
			12,520	1,500

'A 1'—Contd.

	6	7	8	9
227.	Determination of the ideal Conditions for the Commercial Storage of Eggs, Punjab ..	..	..	..
228.	Popularising the rearing of baby chicks, I.V.R.I. ..	..	..	..
229.	A.D.I.O. (Poultry), Andhra ..	7,000·00	..	..
230.	Poultry development American Mission, Madras ..	81,224·00	(+) 76·00	(a)
231.	Study of Cross breeding in poultry, Allahabad ..	32,781·93	(+) 218·07	(a)
232.	Keeping Poultry in battery in W. Bengal ..	5,400·00	..	..
233.	Rearing of White Leghorn Chicken Y.M.C.A., Martandam ..	1,391·78	(+) 8·22	(a)
234.	Defertilization of eggs, I.V.R.I.	8,000·00	..	..
235.	Investigation of possibilities of correlation between physiological and body characteristics of egg productions, I.V.R.I. ..	10,500·00	..	..
236.	Helminth parasites affecting Poultry, I.V.R.I. ..	628·00	(+) 72·00	(a)
237.	Formation of hybrids from early tested inbreds of white leghorn and Rhode Island Red, U.P.	15,000·00	..	..
238.	Comparing performance of different Strains of Poultry by applying random sample tests, I.V.R.I. ..	..	..	..
239.	Cheap Poultry houses, Madras	1,800·00	..	..
240.	—do— Bihar ..	3,500·00	..	..
241.	—do— Orissa ..	1,700·00	..	..
242.	—do— U.P. ..	2,000·00	..	..
243.	—do— M.P. ..	..	..	..
244.	Investigating the advantages of biology production large Unit, Hyderabad ..	11,500·00	..	..
245.	Economic Poultry Ration, Mysore ..	..	..	..
246.	—do— U.P. ..	..	..	..
247.	Scheme for investigating the advantages of producing Poultry in large unit, Nagpur, Bombay ..	1,500·00	..	..

APPENDIX

1	2	3	4	5
			..	1,700
			9,000	6,000
			..	15,100
			..	..
			6,000	12,700
			14,000	..
			1,000	..
			4,000	..
			4,000	3,000
			2,000	..
			50,000	15,000
			10,000	10,000
			12,000	10,000
			6,000	8,600
			20,000	8,900
			2,000	..
			50,000	30,400
			..	510

'A 1'—Contd.

	6		7	8	9
248.	Duck breeding, Bihar	..	1,624·00	(+) 76·00	(a) Inconsiderable
249.	—do— Kerala	..	6,261·66	(—) 261·66	(a)
250.	—do— I.V.R.I.	..	15,100·00	..	..
(i) <i>Fish</i>					
251.	Processing of unpopular fish, W. Bengal	.. ..	..	..	..
252.	Study of Microbial flora-fresh water fish from Bay of Bengal, W. Bengal	.. ..	12,632·00	(+) 68·00	(a)
253.	Farming of fresh water Prawns in Confined Water, Andhra	..	..	..	..
254.	Preparation of Peptone from fish, Andhra Pradesh	..	..	..	..
255.	Improved method of fish preservation, Andhra Pradesh	..	..	..	..
256.	Brackish water fish culture, Madras	.. ..	3,000·00	..	..
257.	Improved methods of transport and short time preservation of fresh water fish, W. Bengal	..	..	..	..
258.	Hydro-trological and Finistic Survey of the Godavari Estuarine system Andhra University		15,000·00	..	..
259.	Ecology of fresh water fish in U.P. Lucknow University	..	10,000·00	..	..
260.	Research in Paddy-cum-pisciculture in Krishna District, Andhra	.. ..	10,000·00	..	..
(j) <i>Apiculture</i>					
261.	Establishment of Bee-keeping Centre, Madras	.. ..	8,580·74	(+) 19·26	(a)
262.	Northern Region Chamba, H.P.		8,860·00	(+) 40·00	(a)
263.	Improving honey yield of bee-hives, Andhra Pradesh	..	..	..	..
(k) <i>Miscellaneous</i>					
264.	Award of fellowships in A.H. Subject, I.V.R.I.	.. ..	30,400·00	..	(a) Inconsiderable
265.	Award of fellowship in Dairy-ing, I.D.R.I.	.. ..	504·23	(+) 5·77	(a)

'A 1'—Contd.

	6	7	8	9
266.	Diploma course in Swine Husbandry and pork processing at Central Dairy Farm, Aligarh, U.P.	..	..	..
267.	Using cow for work, I.D.R.I. ..	..	..	..
268.	-do- I.V.R.I. ..	..	..	..
269.	Post-graduate course in Parasitology, Madras	881·00	(+) 19·00	(a)
270.	Award of Fellowship in A.H. subjects, N.D.R.I. (Karnal) ..	10,000·00	..	..
271.	-do- Bombay ..	3,500·00	..	..
272.	-do- Calcutta ..	3,600·00	..	..
	Total A.H. Schemes ..	16,12,702·35		

(ii) COMBINED AGRICULTURE AND ANIMAL HUSBANDRY SCHEMES

(a) *Development*

1.	Improved axles and hubs, I.A.R.I.	..	..	..
2.	Improved bullock drawn agriculture implements, B. R. College, Agra	5,880·00	(+) 20·00	(a)
3.	Production and trial of Agriculture Implements, I.A.R.I. ..	..	..	..
4.	Refresher Course in Agriculture for young farmers, Andhra ..	..	..	..
5.	-do- Amravati ..	..	..	..
6.	Refresher Course in Agriculture for young farmers, V.P. ..	..	..	..
7.	-do- Hyderabad ..	..	..	..
8.	-do- Bombay ..	..	..	..
9.	-do- Mysore ..	..	..	..
10.	Survey of indigenous Implements, I.A.R.I.	..	..	..
11.	-do- U.P. ..	..	..	..
12.	-do- Orissa ..	..	..	..
13.	-do- Mysore ..	..	..	..
14.	-do- Rajasthan ..	..	..	..
15.	-do- V.P. ..	..	..	..

APPENDIX

[illegible]

'A 1'—Contd.

	6	7	8	9
16.	Research fellowships in agriculture, Government Agriculture College, Kanpur, U.P. ..	..	..	..
17.	-do- B.R. College, Agra ..	..	..	..
18.	-do- Other States ..	..	..	..
19.	Survey of Additional Indigenous Agricultural Implements All States Jammu and Kashmir ..	..	..	..
20.	-do- Kerala ..	..	..	..
21.	-do- Orissa ..	..	..	..
22.	-do- Bihar ..	..	..	..
23.	-do- Andhra ..	2,363·24	(+) 36·76	(a)
24.	-do- Madras ..	..	..	..
25.	-do- U.P. ..	3,630·00	(+) 70·00	(a)
26.	-do- Punjab ..	..	..	..
27.	-do- Bombay ..	..	..	..
28.	-do- Assam ..	..	..	..
29.	-do- M.P. ..	..	..	..
30.	-do- Rajasthan ..	..	..	..
31.	-do- W. Bengal ..	..	..	..
32.	-do- Mysore ..	..	..	..
33.	-do- I.A.R.I. ..	17,000·00	..	..
34.	Survey of fertilizer practices in Meerut District, U.P. ..	7,780·00	(+) 20·00	(a)
35.	-do- Kerala ..	5,250·00	(+) 50·00	(a)
36.	Scheme for the trial of imported Agricultural implements, Orissa ..	..	..	..
37.	-do- Bihar ..	..	..	..
38.	-do- Punjab ..	..	..	..
39.	-do- Madras ..	..	..	..
40.	-do- M.P. ..	..	..	..
41.	-do- Rajasthan ..	..	..	..
42.	-do- U.P. ..	..	..	..
43.	-do- Mysore ..	..	..	..

APPENDIX

1	2	3	4	5
			2,000	..
			2,000	..
			2,000	..
			2,000	..
			2,000	..
			..	..
			..	..
			..	..
			..	1,640
			20,000	..
			16,250	..
			10,700	33,700
			2,000	..
			15,000	28,200
			10,000	..
			5,000	..
			10,000	..
			6,670	540
			6,000	..

' A 1 '—Contd.

	6	7	8	9
44. Scheme for the trial of imported Agricultural implements, Bombay	..	..	..	..
45. -do- Kerala ..	..	..	..	..
46. -do- Assam ..	..	..	..	..
47. -do- Andhra ..	..	..	..	..
48. -do- J. & K. ..	..	..	..	..
Total Combined Agriculture and A.H. Schemes	..	41,903·24	..	..
(iv) <i>Marketing Scheme</i>				
1. Provincial Marketing Schemes	..	..	..	..
Total Marketing Schemes	..	..	..	..
(v) <i>Statistical and Miscellaneous</i>				
1. Cold Storage Scheme ..	..	..	..	..
2. Method and Practice of Farm Accounts, Gokhale Institute ..	1,631·00	(+) 9·00	(a)	
3. Scheme for studying the intensive cultural practice in small holding, Calcutta University	..	..	..	..
4. Pilot sample investigation practices and yield on orange crops, Bombay	..	..	..	..
5. Pilot sample investigation on the cultivation practices and yield in Mango crops, U.P. ..	33,660·00	(+) 40·00	(a)	
6. Advantage and Economics of mechanised farming, Madras	..	..	..	..
7. Pilot Scheme for study of cultivation practices and yield of guava crops in Allahabad, U.P.	28,170·00	(+) 30·00	(a)	
8. -do- Banana Crops, Kerala ..	..	..	..	..
9. -do- Lime Crops, A.P.	..	..	..	..
10. Survey to work out the cost of production of sheep and wool, Rajasthan	..	..	..	..
11. Study of mechanised farming, Benaras Hindu University ..	5,360·00	(+) 40·00	(a)	
12. Study of Economics of Breeding, Bombay	..	..	..	..

APPENDIX

1	2	3	4	5
			27,000	..
			..	..
			..	..
			6,880	13,000
			20,000	..
			10,800	..
			25,000	..
			12,000	..
			8,000	..
			4,000	..
			..	3,000
			..	1,500
			..	15,600
			..	49,100
			..	54,800
			8,000	..

'A 1'—Contd.

	6	7	8	9
13. Scheme for further investigation on the technique of sampling of fleeces for weaving wool quality, Bombay	..	..	..	..
14. Study of farm and non-farm employment in South Arcot District, Anamalai University	..	..	..	..
15. Sugarcane Production, Other Centres	..	..	..	..
16. Pilot Sample Survey Pepper, Kerala	12,964.44	(+) 35.56	(a)	
17. Scheme for study of Economic Conditions of Ghata Prabha left Bank Canal Area, Mysore, ...	..	..	..	..
18. Study of Production and consumption Aspect of Agriculture families in different class structure at Anand, Bombay.. ..	..	..	..	..
19. Pilot scheme for study of incidence of pests and disease of rice, Orissa & I.C.A.R.	..	..	..	..
20. Investigating the cost of production of sheep and wool, Andhra Pradesh	..	..	..	..
21. Pilot scheme for study of cultivation of fruits and vegetable crops, other centres	..	..	..	..
22. Appraisal of over-all benefits of improvement in Farming and possibilities of budgeting, Bihar	..	..	..	..
23. Scheme for the Establishment of a research-cum-testing centre for bullock-driven agricultural Implements, Coimbatore	3,000.00	..	..	..
24. Pilot investigation for collection of statistical data on yield and extent of Cashewnut Cultivation, Kerala	1,500.00	..	..	..
25. -do- Mysore	15,600.00	..	..	..
26. Scheme for the survey for estimating the cost of production of milk in Calcutta	49,050.00	(+) 50.00	(a)	
27. Scheme for ascertaining the cost of milk production, Madras	54,754.00	(+) 46.00	(a)	
28. Enquiry into the cost of production of vegetable, Punjab	..	..	..	..

APPENDIX

1	2	3	4	5
			12,000	..
			8,000	..
			12,000	..
			..	..
			..	..
			..	..
			..	24,100
			37,000	37,300
			15,000	..
			50,000	..
			50,000	..

'A 1'—Contd.

	6	7	8	9
29. Scheme for enquiry into factors influencing cropping pattern on individual holdings, B. R. College, Agra		..	..	..
30. -do- Andhra Pradesh		..	..	..
31. -do- Other Centres		..	..	..
32. Investigation on the adoption of improved practices and the capital invested on different types and sizes of forms ..		..	..	..
33. Survey to work out the cost of production of sheep and wool, Bombay		..	..	..
34. -do- A.P.		..	..	..
35. Scheme for the Establishment of a Research-cum-testing centre for bullock-driven agricultural implements, I.A.R.I. ..		24,100·00	..	..
Total Miscellaneous Schemes		2,29,789·44		
<i>D. Contribution to Institutions</i>				
1. Commonwealth Agricultural Bureaux Imperial Institute of Mycology, Imperial Institute of Entomology, Farnham House Laboratory, Imperial Bureaux of Dairy Science, Fruit Preservation Research Station, Campden		37,250·00	(+) 50·00	(a)
Total D-Contribution ..		37,250·00		
<i>E. Debits and Remittances</i>				
1. Loans and Advances ..		12,467·00		..
2. Deposits and Advances repayable		(6,10,677·81) (78,051·12)		..
3. Payment of income tax, Provident Fund etc.		38,822·00		..
Total Debits and Remittances		7,40,017·93		..
Refund to the G/I during the year		7,56,380·26		..
Investment and re-investment		41,40,000·00		..
Closing balance as on 31-3-60		14,77,550·91		..
Grand Total ..		148,18,150·29		..

APPENDIX 'A 2'

As ON 31-3-1960

Sl. No.	Particulars of Securities	Purchase Value
1.	3 % Stock 1963-65	15,54,334.00
2.	2½ % Stock 1962 (i)	4,02,736.56
3.	-do- (ii)	5,50,000.00
4.	3% Govt. of India Loan, 1970-75	54,99,882.02
5.	3½ % National Plan Bonds 1961	10,00,000.00
6.	3¾ % Loan 1974	34,99,902.00
7.	4% Loan 1972	18,56,200.00
8.	4% Loan 1979	5,00,000.00
9.	23 Short Term deposit Receipts No. A001122 to A001144 for Rs. 50,000/- each	11,50,000.00
10.	17 Short Term deposit Receipts No. A167211 to A167227 for Rs. 1,00,000/- each	17,00,000.00
11.	16 Fixed Deposit Receipts No. A167381 to A167396 for Rs. 1,00,000/- each	16,00,000.00
12.	6 Fixed Deposit Receipts No. A167748 to A167753 for Rs. 1,00,000/- each ..	6,00,000.00
<i>Particulars of Securities from Provident Fund Account</i>		
1.	12 Year National Savings Certificates Nos. NS/F087031 to 087035, 087037 to 087041	50,000.00
2.	12 Year National Savings Certificates Nos. NS/F028496, 028497, 063601 to 063610	60,000.00
3.	12 Year National Savings Certificates Nos. NS/F087258 to 087263 ..	30,000.00
4.	3½ % National Plan Loan 1964 Safe Custody Receipt No. DH-295 ..	34,606.25
5.	3½ % National Plan Loan, 1964. Safe Custody Receipt No. DH-296 ..	14,838.28
6.	12 Year National Savings Certificates Nos. G113337 to G113346 ..	50,000.00
7.	12 Year National Savings Certificates Nos. F087126 & G110921 to G110931 ..	60,000.00
8.	12 Year National Savings Certificates Nos. G015275 to G015288 ..	70,000.00
9.	Short Term Deposit Receipts No. F22339	20,000.00
10.	12 Year National Savings Certificates Nos. G235801 to 235828 ..	1,40,000.00
Total ..		2,04,42,499.11

APPENDIX
INDIAN COUNCIL OF
STATEMENT OF RECEIPT &

Receipts and Opening Balance						
						Rs. nP.
I.	Opening Balance ..	..	..	..	..	30,83,639·23
II.	Receipts under A.P.C. Act ..	..	..	..	..	49,46,604·00
III.	Contributions and Grants:					
	(a) From Central Government ..	..	..	..	..	7,55,235·00
	(b) From State Government ..	..	..	..	..	Nil
	(c) Special Grants ..	..	..	..	..	4,13,968·00
IV.	Interest from Investments ..	..	..	..	..	6,51,387·58
V.	Miscellaneous Receipts ..	..	..	..	..	7,98,835·03
VI.	Debts and Remittances ..	..	..	..	..	3,68,481·45
VII.	Investments and Re-investments ..	..	..	..	..	38,00,000·00
Total ..						<u>1,48,18,150·29</u>
I.	Opening Balance ..	..	..	..	..	30,83,639·23
II.	Receipts during the year ..	..	..	..	..	79,34,511·06
III.	Investments and Re-investments ..	..	..	..	..	38,00,000·00
Receipts plus Opening Balance ..						<u>1,48,18,150·29</u>

'A 3'

AGRICULTURAL RESEARCH

EXPENDITURE FOR THE YEAR 1959-60

Expenditure and Closing Balance					Rs.	nP.
					Rs.	nP.
1.	Standing Charges	..	..	..		11,69,720·25
2.	Research training Publicity, etc., under direct control of I.C.A.R.:					
	1. Agriculture	..	..	..	7,14,264·08	} 20,72,628·73
	2. Animal Husbandry	..	..	..	84,514·62	
	3. Miscellaneous	..	..	..	12,73,850·03	
3.	Grants-in-aid:					
	(a) Agriculture	..	..	..	25,40,207·18	} 44,24,602·21
	(b) Animal Husbandry	..	..	..	16,12,702·35	
	(c) Combined Agricultural and Animal Husbandry	..			41,903·24	
	(d) Marketing	..	..	..	Nil	
	(e) Miscellaneous	..	..	..	2,29,789·44	
4.	Contributions to Institutions	..	..	..		37,250·00
5.	Refund to Government of India during the Year..			..		7,56,380·26
6.	Debts and Remittances	..	..	..		7,40,017·93
7.	Investments and Re-investments	..	..	..		41,40,000·00
8.	Closing Balance	..	..	..		14,77,550·91
	Total	..				<u>1,48,18,150·29</u>
I.	Payment during the year	..	..	..		92,00,599·38
II.	Investments and Re-investments	..	..	..		41,40,000·00
III.	Closing Balance	..	..	..		14,77,550·91
	Total Expenditure plus Closing Balance	..				<u>1,48,18,150·29</u>

APPENDIX 'A 4'

PARTICULARS OF CLOSING BALANCE

1.	Cash in hand as per cash Book on 31-3-1960	..	..	..	3,342·02
2.	Bank Balance (Gn. a/c ledger) on 31-3-1960	..	..	..	13,04,508·16
3.	Provident Fund Balance	..	..	..	1,69,700·73
				Total ..	14,77,550·91

Financial Position (Assets) of the I.C.A.R. (Research Side) on 31-3-1960

(i)	Closing balance as per details given above	..	..	14,77,550·91
(ii)	Purchase Value of Securities	..	..	2,04,42,499·11
(iii)	Imprest (in the name of Additional Secretary, I.C.A.R.)	..	..	1,000·00
			Total ..	2,19,21,050·02

(Sd.) J. P. VAISH

Under Secretary (F),

Indian Council of Agricultural Research.

Certified that the above accounts have been audited and found correct subject to remarks in the inspection report.

(Sd.) J. N. GUPTA

Asstt. Accounts Officer

